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CHENA, JHUMING, TAUNGYA, OR LADANG.*

There can be no doubt that chena "cultivation" is a most vicious and destructive way of exploiting a country, and there can be no doubt that it is, theoretically, unnecessary—that the land will stand continuous cropping. There is no reason to suppose that it will not do so—no soil is so poor as all that, where manure or green manure exists, and there is rain.

The fact is that chena cultivation is a symptom, showing the existence in Ceylon of a *low state of agricultural equilibrium.* Unthinking people declare that native agriculture in Ceylon is in a state of comparative perfection, that the methods and crops cannot be improved. Nothing can be more untrue, and the reason that attempts to improve the quality of the crops or the tools have hitherto failed, is that people have taken hold of the wrong end of the stick, or rather, have attempted to lift the wrong lever.

What is really the case is that agriculture among the villagers has slowly sunk to a low level, if indeed it were ever at a much higher one, and everything fits in with something else, so that, *for that level,* the methods in use are the best. We have before us the problem of raising the level.

It is no use trying to improve the agriculture before we have first of all made sure that all the preliminaries to successful and progressive agriculture are properly seen to. The most important of these, as we have described at length elsewhere, are capital, transport, and education. Transport and education facilities have been sufficiently well attended to by the Government, and for years we have been trying to persuade people that capital is the essential key-note of progress in Ceylon. The European planter is able to go ahead with crops like tea, rubber and cacao because he has the capital at his back to tide over the period of waiting, and he can adopt improved methods for the same reason.

Chena cultivation is one of many indications of a poor people, not possessing the capital necessary properly to develop the land. Practically no capital is necessary to open a chena, and yet a good crop is obtained. The land has been lying fallow for some years, and its fertility is further increased by the scorching it receives during the burning off, and which, as has lately been shown, destroys the amœbæ, &c., which feed upon the more valuable micro-organisms of the soil.

* Burning off the forest, cultivating a crop or two, and abandoning the land.

The opening of the Experiment Station at Maha-iluppalama in the North-Central Province, in the midst of a chena country, has given us the opportunity really to study this question. The land, we were assured by the local villagers, was only fit for chena, but the first glance at the excellent soil showed that this idea was probably absurd. As a matter of fact, we have cultivated it continuously since the N.E. rains of 1904, or six years consecutively, and the crops are as good as ever they were.

The real truth of the chena proposition would appear to be this. The moneyless native clears and burns off the land, and puts in his first crop, which is often a "bumper." He usually tries a second, but the weeds are now getting a firm hold, and greatly reduce the yield, while in a third season it is very commonly hopeless to expect any crop, because of the growth of weeds.

The land is therefore abandoned, and slowly a shrubby growth appears on it, and as it gets taller, the weeds of open ground slowly disappear, and are replaced by the weeds of shady ground, which when the land is again opened will disappear. And by leaving the land alone some years, not only do the weeds of open ground, which were so troublesome, disappear, but a large proportion of their seeds also die, so that when the land is again re-opened it is not at once covered by these weeds. After 8 to 50 years the chena process is repeated, most often in the wettest regions, where the growth upon the chena most rapidly reaches height and density.

All our work at Maha-iluppalama goes to show that chena land may be kept in a state of continuous cropping, provided that the weeds are kept down. This of course necessarily means much greater expenditure upon weeding. Allowing for the fact that the chena cultivator as a rule does not injure his health by excessive devotion to work, it is probable that he might be able to keep his chena under crop, but he would likely have to reduce the area. But he would also have to spend more on tools, fencing and other things, and therefore must necessarily have more command of money than he has at present.

Chena in private hands cannot of course be interfered with, though every encouragement should be given to experimenting with continuous cropping, rotation of crops, permanent crops, and the like. But it may be suggested that no chena be allowed on public land unless part of the land be properly holed and planted with coconuts or other permanent crops, at distances of say 30 ft., this crop to become the property of the Government. Many of the trees would doubtless die, but many would grow properly, and the land become of permanent value.

As the population increases, and the people are driven to harder and less casual work, chena necessarily disappears, and it is in this way that its final exit must probably be looked for.

J. C. W.

GUMS, RESINS, SAPS AND EXUDATIONS.

SYNTHETIC RUBBER.

(From the *Chemist and Druggist*, No. 1, 574, Vol. LXXVI., March 26, 1910.)

"De Indische Mercuur" of March 8 published some particulars of the work done by the Synthetic Rubber Co., which was formed in this country about three years ago to investigate various processes proposed for the manufacture of synthetic rubber. The company first of all examined the Gottschalk process, and this was speedily disposed of, as it was found impossible to produce rubber by it. Attention was then directed to the Heinemann process, which also proved to be valueless, after £1,000 had been expended in experiments with it. At this stage the company undertook research work on its own account, and at one time it seemed to be on the high road to success. At a meeting held in March, 1909, the President announced that they were in possession of a satisfactory method of making rubber, and a call on the shareholders was made in order to defray the cost of large-scale trials. This process is believed to be that invented by Liley, of Oxford University. It is understood that this actually yields a product having the chemical and physical properties of rubber, but that the cost of production is so high as to render its working unremunerative under present conditions. The article continues with the remark that it is not impossible that a syntehtic rubber may be made eventually, but that until the price of natural rubber rises to about 20*s*. per lb., it is very improbable that it

can be made at a profit. The possibility of rubber rising to this value it considers is very remote, since the output from plantations will increase rapdily in the next few years, so that there is likely to be a decline rather than a further rise in price. The view taken in the article referred to seems to be that generally accepted by rubber planters, and it must be admitted that at the present moment the chances for the prosecution of synthetic rubber seem to be poor. It is generally believed that in the most favourably situated and best managed plantations in Ceylon the cost of production of sheet Para rubber of the best quality is about 1s. 2d. to 1s. 3d. per lb., and that such rubber could be marketed profitably at 1s. 6d. On the other hand, it seems to be thought that the only possible raw material for the manufacture of rubber is turpentine oil, and with the production of this article already unable to overtake the demand, it is not a promising source, and its price even now precludes its use for rubber manufacture, even if a good process were discovered. It is a mistake, however, to suppose that there are no other promising raw materials. What is needed is a cheap unsaturated hydrocarbon, capable of ready condensation to form very complex molecules, or an unsaturated acid obtainable in large quantities from which such a hydrocarbon can be easily prepared. Two raw materials naturally suggest themselves in this connection, viz., acetylene, and one or other of the liquid unsaturated acids of the drying and semi-drying oils, and it is probably by the use of such products that the problem will be solved, if it is solved at all.

SUBSTITUTES FOR RUBBER.

By C. SIMMONDS.

(From *Nature*, Vol. LXXXIII., No. 2107, March 17, 1910).

The present demand for india-rubber naturally directs attention to those articles which, to a greater or less degree, may serve to replace rubber in its industrial applications, and so help in conserving the supply.

Of such articles a very large number have been proposed. Those in actual use to any considerable extent are, however, relatively few. For present purposes the various surrogates may be distinguished as (1) rubber-substitutes proper, consisting wholly of ingredients other than rubber; (2) composite or "artificial" rubbers, which contain a certain proportion of natural rubber worked up with other substances; and (3) true synthetic rubber. namely, a product containing the rubber molecule synthesised in the laboratory or factory by chemical means from simpler compounds.

At present the first of these classes is commercially the most important. Scores of recipes are in existence, including very diverse ingredients; but the basis of most is a modified oil. At first sight there seems little suggestion of india-rubber in the properties of an ordinary vegetable oil, but a simple experiment will indicate the kind of modification which certain oils readily undergo, and which help to fit them for use as rubber substitutes. If we test the drying properties of boiled linseed oil by spreading a little of it over a slip of glass and allowing it to dry, a film of oxidised oil is eventually obtained, having a certain modicum of toughness of elasticity. The liquid oil has taken up oxygen, and thereby become converted into a more or less elastic solid. Tung-oil substitute is essentially such an oxidised product, manufactured by heating the raw oil until it has absorbed enough oxygen to cause it to thicken and become solid on cooling, when it is powdered and worked up with a little petroleum.

In a somewhat similar way the oils can be made to take up sulphur, becoming thereby solid and endowed in some degree with elastic properties. The treatment is analogous to the "vulcanisation" of rubber. "Brown" or "black" substitutes are manufactured by heating the oil with sulphur, a process corresponding to the "hot cure" method of vulcanisation. "White" substitutes may be made by merely mixing the oil, cold, with 20 to 40 per cent. of sulphur chloride; or, better, by first dissolving the oil in a suitable solvent such as carbon tetrachloride. This resembles the "cold cure" process used in vulcanising rubber. Colza oil is largely used for these purposes, but various others are available—linseed, maize, arachis, and castor oils, for example. The chemical reaction involved is a somewhat complicated one, but probably it consists mainly in the formation of what chemists term an "addition-product." The proportion of sulphur taken up by the substitutes varies rather widely, ranging from 5 to upwards of 15 per cent. As would be expected, oils which have previously been oxidised to a notable extent (*e.g.*, "blown" oils) require less sulphur to saturate them than do the natural oils.

"Nitrated" oils are also used as the basis of some rubber surrogates. Thus

one well-known product is a solution of a nitro-cellulose in linseed or castor oil which has been nitrated by treatment with a mixture of nitric and sulphuric acids. Other such articles are made by oxidising the nitrated oil with lead peroxide, or by simply heating it in air.

These oxidised, sulphured, and nitrated oils, in one form or another, are largely used as substitutes for rubber. Of the other substitutes proposed, a few examples may be given, to indicate something of their general nature.

First, there are those which, while still retaining oil as one ingredient, include also other important constituents. Thus, "Fenton's rubber" is a mixture of oils with tar, pitch, and creosote; which mixture, when digested with nitric acid, gives a toughened mass, and this on heating yields an elastic product simulating rubber. "Russian" substitute, said to be useful for covering telegraph cables, contains as ingredients wood-tar, hemp and linseed oils, ozokerite, spermaceti; and sulphur. "Oxolin" is made by impregnating fibrous material such as jute or hemp with linseed oil, oxidising the oily mass with warm air, and working the product up between rollers into a coherent mass, which can then be vulcanised by heating it with sulphur.

In another category of substitutes oil plays only a subordinate part, or is altogether dispensed with. Thus "Jones's substitute" is stated to be made from various gums and gum-like products as the chief constituents. In W. H. Perkin's patent (23,031/07), gelatine or glue is dissolved in creosote and then treated with some reagent—potassium bichromate, formaldehyde, or tannic acid—which will render the gelatine or glue insoluble; after "setting" the mass obtained is digested with acetone to make it firmer. "Textiloid" has for its ingredients various resins, nitrocellulose and camphor. As a curiosity in this class may be mentioned "grape rubber," produced from the skins of grapes by means of pressure; it is not, however, a commercial article. Finally, though this can only be a substitute for rubber in very hard articles, we may mention the interesting material, "bakelite," recently introduced by Dr. L. H. Baekeland. It is a condensation-product of formaldehyde and phenol, which can be moulded as desired, and afterwards hardened.

In what sense are the foregoing articles and their likes to be considered as "substitutes" for rubber? Some persons are disposed to deny them any right to the title, and would look upon them as mere adulterants whenever used partially to replace rubber in what would otherwise be an all-rubber article. Others admit, though sometimes grudgingly, that there is a place which such substitutes can usefully fill. Much depends on what the article is sold as, and on what use it is to be put to. Not all the special qualities of rubber are wanted in all the products for which it is employed. A door-mat is one thing, a bicycle tyre quite another, where a high degree of elasticity is not really needed, as, for instance, in waterproof goods and electrical insulating work, there is a legitimate field for substitutes which may serve the required purpose. Even here they may not be equal to rubber, but they find their justification in their lower cost. After all, we do not need razors to cut sticks with.

It may be said at once that no substitute is equal to rubber in every respect. Chemically, the latter is a very inert substance, much more so than the substitutes. Hence, even if the latter were not otherwise inferior, they would be less durable than rubber under certain conditions. They are nearly all acted upon more or less readily in circumstances where rubber remains unharmed. The modified oils, in fact, are still oils in the sense that they remain glycerides, decomposable by alkalies, as also by steam under pressure. If used for articles exposed to these agencies, they fail in durability, whatever their excellences otherwise.

The fact that substitutes of this class are readily saponifiable by alkalis makes it an easy matter to detect them by analysis when compounded with true rubber. As a rule, the proportion of substitute used is from 5 to 25 per cent., and even the smaller quantity is recognisable.

Of the composite rubbers (or "artificial rubbers," as they are sometimes called), one preparation, which has been made in quantity, and is said to be excellent for many purposes, has for its basis Guayule rubber incorporated with certain gums. Another such article is compounded of natural rubber and some other substance of vegetable origin, probably a latex or a gum, reputed to contain the same chemical elements as rubber and in much the same proportion. Such articles are, of course, only partially "substitutes" for rubber, and their cost rises with that of the latter ingredient. Moreover, if any very large demand for them arose, there is always the possibility that the supply of gums and latices would become insufficient;

and the advantage of lower cost would thus tend to disappear.

Coming now to true synthetic rubber; a question often asked is whether there exists any probability of such an article being manufactured and displacing natural rubber, either wholly or to any large extent. Will rubber plantations go the way of madder fields and indigo cultivation? Well, the future is on the knees of the gods. In the face of the precedents just mentioned, to say nothing of others, he would be a bold man who would venture to say that even the best quality of rubber may not some day be made on a commercial scale from cheaper materials such as beet sugar and calcium carbide. But the day is not yet. There are beginnings; there are clear indications of the direction in which to proceed; there is distinct progress to note. But there is still some distance to go, and the end of the journey may not be even in sight.

India-rubber chemically is essentially a polymerised terpene. An article patented some time ago, and named "turpentine rubber," appears to foreshadow a synthesis of true rubber. Turpentine is a mixture of terpenes, and the article in question was to be obtained by passing turpentine through a hot tube, and treating the resulting vapours with hydrochloric acid. The result is a solid condensation-product; and the idea at the base of the process appears to be the production of polymerised terpenes having some of the elastic properties of rubber.

A more promising, because a more scientific way, is that outlined in Heinemann's patent No. 21,772 of 1907. Here a true synthesis is attempted. It is based upon the well-known fact that rubber is probably a polymer of the semi-terpene isoprene. The first step is the production of the unsaturated hydrocarbon divinyl, $CH_2 : CH. CH : CH_2$. This is obtained by passing mixed acetylene and ethylene gases through a heated tube. With methyl chloride, divinyl yields isoprene (methyl divinyl $CH_2 : C(CH_3). CH : CH_2$); and the isoprene on treatment with strong hydrochloric acid is converted by a union of molecules into a substance closely resembling caoutchouc, if not identical with it. The raw materials, so to speak, are thus acetylene, ethylene, and methyl chloride, which are themselves obtained by any of the ordinary methods, *e.g.*, from calcium carbide, alcohol, and beet sugar residues respectively. The question is, can this or some other comparatively simple synthesis, theoretically quite possible as a laboratory operation be translated into a practicable and profitable mode of manufacture on a large scale? One of the first doubts to arise is whether the synthesised caoutchouc will have the physical properties of natural rubber; or whether these, by any course of treatment can be imparted to it. This doubt resolved, there comes the question of economical production in competition with the natural product. Much time and thought have been spent on the problem of synthetic rubber, and it is safe to conclude that there will yet be many a headache before it is solved. Judging by what is known to have been done rather than by the promises, owners of rubber plantations may for the present sleep peacefully in their beds.

DANGERS, MISTAKES, AND IMPROVEMENTS IN THE CAOUTCHOUC PRODUCTION OF ASIA. II.

(By D. SANDMANN in *Tropenflanzer*, April, 1910. Abstracted by J. C. WILLIS.)

The milk should as soon as possible be made into rubber, before decomposition sets in. He states that rubber made by allowing the milk to stand until sour is less elastic. The milk in transport to the factory should be protected from the heat of the sun. He recommends a horsehair sieve as more easily kept clean.

The various methods of coagulation, and machines in use for preparation of rubber are then described.

FUNTUMIA ON THE IVORY COAST.

(By A. CHEVALIER, *Journ. d'Agri. trop.*, February, 1910. Abstracted by J. C. WILLIS.)

M. Chevalier leaves undecided the question whether Funtumia or Hevea is best suited to Western Africa. The former is of course native there, whereas here in the East, where both species are foreign, Funtumia has shown itself very liable to the attack of a native caterpillar, and its cultivation involves a good deal of expense in spraying, and its growth is but slow.

Rubber can be prepared by boiling the latex, and this method is recommended for native use, though the natives are giving it up in favour of coagulating by aid of the latex of certain lianes, such as species of Strophanthus? or sometimes by solution of soap (½ a bar of Marseilles soap to 45 litres of latex).

NOTES ON THE PREPARATION OF RUBBER FROM *FUNTUMIA ELASTICA* ON THE IVORY COAST.

(By A. CHEVALIER, in *Bull. Jard. Col.*, 1910. Abstracted by J. C. WILLIS.)

All over this district the natives bleed the trees by herring-bone incisions, the ribs of which often meet round the tree. The same trees are bled at intervals often of less than six months. The herring bone is taken right up the trunk and often out upon the branches, but the higher cuts do not heal with the rapidity of the lower. Many trees have been destroyed by the tapping that has gone on, for Funtumia is not a good resistant tree. He recommends that it be not bled before the eighth year.

REMARKS ON THE SELECTION AND THE BLEEDING OF MANIHOT GLAZIOVII.

(By O. LABROY, *Journ. d'Agr. trop.*, 31st March, 1910. Abstracted by J. C. WILLIS.)

He refers to a preceding article by M. Cardozo, according to whom the good trees in a Ceara plantation do not exceed 20 %, and goes on to state that one cannot tell the good trees by external examination of the leaves, &c., though it is supposed that the trees of poor yielding capacity have a thick much fissured bark. He then goes on to consider the various methods proposed for improving the breed. It may be noted that careful selection of Ceara Rubber is already well under way at Peradeniya.

SOME REMARKS ON RUBBER GATHERING IN EASTERN PERU.

BY W. T. BURRES.

(From the *American Review*, Vol. I., No. 2, February, 1910.)

Having been asked to tell you something about rubber in Peru,—I refer to wild, not cultivated rubber—so far as it came under my observation during the time I spent in that country, I will endeavour to recount to you, as briefly as I can, some of my personal experiences while acting as surgeon of an American mining company in Peru.

I must begin by saying that what I know about rubber *per se* is a minus quantity, but, happening to be connected with a company that, among other interests, took up that of rubber, I did see something of its field of operations and certainly learned to appreciate the enormous difficulties and constant dangers attending an enterprise having for its object the collection of this valuable product, the uses for which seem to be daily increasing in the manufacture of articles of all sorts from automobile tires to hygienic tooth brushes.

You, gentlemen, are, of course, primarily interested in cultivated rubber, but, inasmuch as the wild product constitutes at present by far the greater proportion of the world's total supply, I assume that, along with your efforts to replace, by scientific cultivation of the various species of rubber-producing trees, the drain upon the natural sources, which, immense as they are, are yet not inexhaustible, you pay some attention to what is being done in the opening up of new fields of supply.

The area of eastern Peru is very great, —very much greater, indeed, than is usually supposed. When one speaks of South America one does not at once conceive of it as composed of a number of very large countries, but perhaps rather the contrary; one seldom realises that Brazil for instance, is almost as big as the United States, excluding Alaska. But, reverting to Peru, I may remark that the frontier between this country and Brazil has a length of between 1,600 and 1,800 miles. As much as from three to six months are frequently occupied by native rubber producers in the making of a round trip from one district to another, travelling as they do by canoe along the various waterways and occasionally making rather difficult portages. When, therefore, we here in Mexico have to get to points involving perhaps a horseback or muleback ride of four or five days, and think we are pretty remote from civilisation, such ventures sink into insignificance in comparison with the month-long journeyings which the pioneer in South America has to undertake in pursuit of his business.

Upon the first trip that I made into the interior of Peru after reaching the Pacific coast of South America, where I had often been before, we started from Mollendo,—which serves as the chief port for Southern Peru and Bolivia (the latter country having now no seaboard at all of its own),—proceeding, by rail, via Arequipa, having an elevation of 7,500 ft. above sea level, up into the plateau of the Andes, occupy-

ing three days on the way, and leaving the train at a place called Tirapata. From there we had to take animals and ride across the large range of the Andes, attaining at one point an altitude estimated at 17,000 ft. above sea-level; we then started down the eastern slope over the now well-known trail of the Santo Domingo Mines. The change in level was very abrupt, dropping in eleven hours from something like 17,000 ft. to 2,000 ft. The trip took five days on horseback.

I was at that time surgeon of a mining company whose directors, being possessed of a lot of human nature, thought that there was not enough doing in extracting ores from the bowels of the earth, and decided therefore to branch out into the rubber business. In pursuance of this scheme an expedition of which I was a member was organised, and in due course started out. We explored a big section of practically hitherto unknown country, traversing never before reached by white men and discovering, among other things, a new river, which, at the instance of the Peruvian Government, we named the West River, after a Dr. West who had made some important exploration trips some distance to the north during preceding years. We suffered many hardships and went through many dangers, but fortunately without any loss of life. It was an intensely interesting and exciting trip in every way. Without going into the numerous details of our experiences, I may say that the result of our undertaking was the opening up of a new rubber country, followed by the formation of million dollar company to exploit the same. I became surgeon of the company in connection with my medical work at the mines. Very soon a force of between three hundred and four hundred men was put to work. I left the mining camp every six weeks to go into the rubber country, taking with me all necessary supplies. The country was very unhealthy in parts, the sick list being as high at times as forty per cent. Application was made to the Bolivian rubber men for "Caoutcheros." The Company estimated that they had available a yearly supply of 300,000 pounds of rubber, capable of being largely increased. They ordered and obtained from the United States, at considerable cost, a shallow draft steamer for general transportation service on the rivers, and finally got things in fairly satisfactory running order. They worked the business in two ways. They imported expert rubber gatherers to explore and open up the rubber forest; and they sent agents down certain tributaries of the Amazon to interest the rubber gatherers (who were mostly Peruvians and Brazillians) in trading with the company on a basis of exchange of commodities. Thus the company got a large quantity of rubber already prepared by the native gatherers according to native methods.

To give you an idea of the cost of getting that rubber out, I must tell you that, after repacking it in such a manner as to adapt it to transport on the backs of mules and Indians, it had to be carried for at least ten days in this way to reach the nearest railway station. Thence it had to be conveyed to the Pacific port of Mollendo, this taking three days and forming the most expensive item in the transportation bill. It may be asked why shipment should not be made directly down the Amazon to Para instead of the seemingly complicated route I have described. The answer is simple,—namely, on account of the existence of a series of rapids extending for a distance of over one hundred miles on the Modera River, the chief tributary of the Amazon, which, although navigable at certain seasons of the year, are very dangerous, making the percentage of loss in their passage very high. To make the business profitable, the company had to buy the rubber at a very low price,—50 cents per pound,—exchange being the same as in Mexico. If the company had gathered the rubber themselves, it would have cost them much more, on account of lack of experience in the work. The company spent on enormous sum of money, principally in the opening of a main trail and the building of stations, as well as on the introduction of supplies; so that they had to do business on an extensive scale in order to realise even a moderate return on the capital expended.

The chief product was rubber, derived from a species of *Hevea*. This tree, although presenting no very striking characteristics, is easily recognised once it is known. The natives cut down entirely all the large trees claiming that they would die anyway, if left to stand after two or three tappings, by which a less quantity of caoutchouc would be obtained than by one thorough tapping completely draining the tree of its latex. From twenty, twenty-five to one hundred pounds of rubber were often taken from a single tree. Young trees of volunteer growth were always coming up, and it was said that in ten or twenty years there would be a new rubber forest. The forests in which these *Hevea* trees occurred were

in the low level country. In the foot *hills*, at elevations from 2,000 to 5,000 ft. above sea level, another rubber producing tree was found. This was regularly tapped, but, never cut down. It gave a superior, and consequently higher priced grade of rubber, but in less quantity.

With regard to cost of transportation and supply, it is possible that the former may be reduced somewhat, as improved means of communication are provided, but it will never be cheap. So far as production is concerned, that is diminishing all the time, as is natural. Only a little planting of rubber is being done in South America in old and exhausted sections. There are, it is true, enormous reserves as yet untouched, but these are being rapidly exploited and cannot, of course, last indefinitely. All the affluents of the Amazon are being constantly worked by the rubber gatherers, and we found that when we penetrated the remotest portions of the country and reached the Rio Madre de Dios, taking two months on the trip, these rubber gatherers were already on the ground. Under the terms of a treaty which Brazil concluded with Bolivia in regard to the Acre region, the Brazilian government agreed to build and operate a railway parallel with the Madera Falls, to afford an outlet for the product of Bolivia; and I believe that steps are being taken to commence this important work. Some English and French rubber companies used to send their product by the Madera River, but lost a great quantity in doing so. The construction of the railway referred to will open up a vast section of new country, principally in north-eastern Bolivia, and will materially facilitate the transportation, in both directions, of both Bolivia and Peru.

With regard to the labour employed by the company, I may say that the real workmen for packing or other unskilled labour were the Quechua Indians, brought from the plateaus of the mountains, who were fairly civilised; but the natives encountered in the forest country were absolute savages, and undoubtedly up to the time of which I speak the majority had never seen white men. These savages, of which there were a number of tribes known generally as "Chunchos" wore practically no dress; the women adorned themselves with tooth necklaces and nose pendants, and many had their bodies painted. These people lived mostly by hunting and fishing and on the natural fruits of the country, including some half-cultivated bananas, which latter occasionally afforded our party an emergency food supply. Some of these tribes were exceedingly fierce and implacable, but, if well treated, they would be friendly. We had no real difficulty with them at any time, because perhaps we were constantly on guard and well armed. They had a wholesome respect for fire-arms. In every new section of rubber country opened up by the "Caoutcheros" these savages were immediately "civilised" according to the standard of the former; they were taught the use of tobacco and alcohol and robbed of their most attractive women,—who, by the way, were more often than not the cause of inter-tribal wars. I am speaking, it must be remembered, of conditions as they existed four years ago, during my first trip to those regions. Association with white men has doubtless had its effect upon the native and changed (but not necessarily improved) his character; and I dare say that to-day one would have to go into still more remote parts to see the real savage with all the weird accompaniments of his aboriginal state.

I have, of course, made no attempt in an extemporaneous talk like this to deal in any detail with so large a subject as that of the rubber industry, nor do I desire to pose as an expert or authority in this line. I have simply tried to give you a sketch of the conditions as I found them.

NOTES ON CEARA RUBBER IN GERMAN EAST AFRICA.

BY T. G. THOMPSON.

(From the *Agricultural Journal, British East Africa*, Vol. II., Part IV., January, 1910.)

Having just returned from a run through the rubber districts of German East Africa, I have pleasure in submitting a few impressions and ideas from a practical point of view. I had the agreeable companionship of a friend who, like myself, is interested in rubber growing, and whose knowledge of the vernacular was of much importance.

Making Tanga our headquarters, and fortified with letters of introduction, the owners of a number of very interesting and important estates were interviewed and the various operations investigated.

I should like to record a sense of the friendliness with which we were received, the willingness displayed to give information, and explain the minut-

est details, and further we were most hospitably entertained. Nothing was a trouble, and to make us comfortable seemed quite a pleasure. It is not my intention to compare or criticise the styles and methods employed on one estate as compared with those on another in such a way as would lead to the identification of these estates. This would be invidious and ill-becoming under circumstances where all were equally agreeable and obliging. I therefore refrain from naming the various properties individually and shall content myself by referring to them generally.

The configuration of the country, though in general flatter than the Mirtini-Mazeras district of B.E.A., is not unlike it in some respects. A fine range of mountains, the Usambara, makes a conspicuous background to several of the plantations. One railway runs from Tanga to Mombo some 80 to 90 miles, and another from Daressalam to Morogoro, while there are good roads from Tanga in various directions where rickshaws can be used. We had a walk one day of about 20 miles from Ngomeni and visited a very large property on which we spent the better part of two days and nights, then we had another good walk to the railway at Muhesa seeing several other Plantations on the way.

What strikes one particularly is the similarity of soil throughout, a rich loamy chocolate approaching a hue of purple in colour, only near the coast it is rather more sandy. The soil is very deep and easily penetrated, nothing that I have seen in B.E.A. is comparable to it, and it is specially adapted to the growth of the Manihot Glaziovii which is the variety universally cultivated. Of course, other branches of the rubber family are exploited and experimented with but not seriously cultivated. The climatic conditions and the character of the soil are all that could be desired for growing the Ceara to perfection, and our neighbours are very fortunate in having found a product so splendidly suitable to their country. It makes one's teeth water when comparison is made with our scantier and less kindly soil, the natural effect of which is a slower growth of the tree and a retarding of the producing period. All the estates visited were in beautiful order "spick and span" to the last degree. The thoroughness of everything as far as cultivation is concerned was most pronounced.

After soil and climate the next important matter is the item of seed, and here our friends have to be commended for their carefulness and foresight. No one in G.E.A. would think of using seed that had not been gathered from a thoroughly mature tree and kept under suitable conditions for a couple of years. Selection is a most important matter in the betterment of tree life, as well as in the animal creation, and here I am sure we shall score heavily when the time comes when we know something of the genealogy and condition of the seed that we are putting in the ground. At present the seed question with us in B. E. A. is a vexed one. It is only natural that growers should retain the best qualities for their own requirements, while seconds and mixed lots become the articles of commerce. In B. E. A. so-called German seed can be purchased at from 1 to 1¼ rupees per lb., but it is not the selected quality. The cheapest seed used for sowing at stake in G. E. A. costs Rs. 2½ there. With the middleman's profit, cost of transit, etc., this would mean about Rs. 4 per lb. here. Yet at this figure it is no more expensive than the lower priced article, for only three seeds need be placed in a pocket while 6 to 9 of the other are necessary. In the result it is not half as costly when the health and quality of the young plants have been taken into consideration. I would rather pay four rupees per lb. for thoroughly selected and properly matured seed than one rupee for an article I know nothing about. These are points not always kept in view, I fear, when laying in supplies of seed. How much heart burning and disappointment are caused by poor germination, and how often is the plant a poor sickly weakling when it does come, all of which could be avoided by a proper selection of seed.

It is the universal custom to sow 'at stake' in G. E. A. instead of transplanting from the nursery. No nurseries are necessary there, and from the nature of the soil much smaller holes suffice for receiving the seed than with us. A boy's fez turned upside down represents the shape and dimensions of the pocket, say 6 inches by 6 inches, while here, 16 inches by 16 inches is usual.

For speedy germination the following are among the plans adopted: When rain is expected soil is spread on a sheet of corrugated iron to the depth of a couple of inches, the seed is placed in this and well watered, it is then covered with another sheet of corrugated iron and placed in the sun. The upper sheet is removed frequently to permit of further watering and a hot moist temperature is maintained. In three days germination has taken place and, provided weather conditions

are favourable, the iron sheet is carried to the holes and the seeds placed in position and lightly covered up. This is a great saving of trouble and expense over the nursery system from which the young rubbers are transplanted when 18 inches to 2 feet high, often subjected to rough handling in the lifting and transplanting which damages and destroys a fair percentage besides throwing back and retarding the growth of the plant.

Another method employed for quick germination is to spread seed on a blanket and cover it up with another, keeping the seed well watered and thoroughly moist in the sun. In a very few days germination takes place, when a couple of seeds are placed in soil in small baskets or rotting pots. These are packed closely together in a shaded place and watered regularly. Whenever the rains come the pots are placed in the holes or pockets loosely packed with soil, and after a time the better of the two plants is left in possession. Though more trouble than the corrugated iron plan I am inclined to favour this latter system as, in the event of the rains not coming when expected, the young plants would have to be watered in the holes and, unless this is done regularly, would speedily wither off and die, whereas it is a much simpler matter to water all the baskets when closely packed together than the holes singly. The average distance of planting is about 10 feet by 10 feet, which brings it out at 435 plants per acre. As two or more plants come up in one hole they are allowed to grow together for a time, when the best is selected to remain and the others are either planted out independently or used for filling up casual vacancies.

The Germans are very careful as to clean weeding from the earliest stages of growth for first few years of the life of the young rubber. After three years the weeds do not trouble them much, and then perhaps a couple of cleanings a year will suffice, but, as I say, in the earlier stages they are very particular. Nor are they keen on intermediate catch crops. Only on one estate did I see a leguminous crop being raised between the lines of rubber. For Ground Nuts and other cereals they seem to have "no time," devoting all their attention and energies to the rubber. With their fine soil it is not necessary to provide a green crop for the nourishment of the plants and, having plenty of it, they do not need to make ridges for the prevention of its being washed away, nor is draining necessary. With the rapid growth of the tree tapping is general by the end of the second year. For the following twelve months the trees are not severely dealt with. They are going through a sort of apprenticeship and getting accustomed to the knife. It is wonderful how the trees seem to take to this and the effect it has on them. Once a tree is tapped it increases more rapidly in girth than one untouched, and evidently settles down at once as a latex producer, in which it can evidently be encouraged. If two trees of the same age and like each other are treated differently this becomes apparent. Say No. 1 is tapped at the end of the second year and No. 2 a year later, it will be found that No. 2 yields no more during its first year's tapping than No. 1 did when a year younger, while No. 1 in its second year's tapping gives considerably more, clearly showing that the yield can be encouraged by tapping judiciously. Though trees are reckoned to be giving a good yield at five year's of age, yet the quantity goes on increasing under favourable circumstances. On one estate there is a tree whose career seems phenomenal. It is now in its eleventh year and during the past twelve months yielded 26 lbs. of moist rubber, while two years ago it was giving considerably less. This tree has been tapped monthly and is in a flourishing condition. No amount of proper tapping seems to injure good trees. They will cease yielding latex if over-taxed, but the life of the tree is not endangered. It just requires a resting time to gather its forces again. During the first year of tapping the Germans are satisfied if a tree yields one quarter pound of wet rubber,—say two ounces of dry. No peeling of the bark is required during this period, but it soon becomes a necessity, as the outer bark thickens very much and becomes a harbourage for white ants and other insects, the refuse from which dirties the rubber. Methods of tapping vary much in different properties. In one case the pricking might be confined to a single section on one side of the tree, while in another it may be in three or four vertical lines, but in no case is pricking permitted all round the trunk at one time. Morning and evening are said to be the best times for tapping, and the part being operated on should never face the sun.

I did not see anything new or striking in the matter of the knife used. Here is one of the things in which I was disappointed at not finding something I had not seen before. Anything seems to do, from an ordinary carver or table knife to a tool made on the premises, something like a chisel with a very flat

edge and sharp so as not to make a widening incision. Preparatory to tapping the section to be operated on is coated with a solution composed in some cases of limes and water, fifty being required for a bucketful. Acetic acid of 2 per cent. or carbolic acid of 3 per cent. strength may be used, while the seeds of the baobab tree are also employed. These contain a certain quantity of organic acid which is found very suitable. The coating of the tree with such a solution is of course to encourage coagulation. I believe that an excellent article for this purpose has recently been put on the market under the name of "purub," but the Germans consider it too expensive, and as we are only discussing what I actually saw in use, the merits of purub are outside our province.

When the latex has been thoroughly coagulated on the tree it is generally rolled off in balls, but in some cases is just pulled off in scraps and folded in the hand. When a sufficient number of balls have been collected they are sliced, are passed through smooth rollers where rinsing in water also takes place, and it passes out in the form of what is known as lace rubber. This is repeated several times till it is quite clean. It is then passed along to the drying and cleaning house where it is smoked for a period of fourteen days, a stove being erected outside the building, the flue of which is carried to the inside. When the rubber is thoroughly dried it is packed in cases for export. Another method is similar, only that the heat is increased during the last few days and the lace rubber is pressed into blocks. Some growers only split waste and smoke the balls, packing and exporting in bags, but this is not considered an advisable system. Yet another method adopted is to pass scrap rubber through fluted rollers, washing as in the first instance. It comes out as crepe rubber, and being pressed and blocked is cut into slices about ⅜" thick by 6 inches square and hung up to dry.

While much impressed by the soil, climate, and the cultivation of rubber in G. E. A., with the consequent remarkable growth of Ceara, it seems to me that far greater advance has been made in Ceylon in what might be termed the manufacturing department of the crude article. G. E. A. strikes one who has been familiar with the treatment of "para" rubber in Ceylon as being much more primitive, finer machinery and plant as well as more scientific methods having been adopted in Ceylon. I do not mean this as derogatory to, but fair criticism of, our German friends. In B. E. A. we are no doubt behind them in natural advantages, but, as far as I can see, that only means it will be later before we can draw supplies, and I put it down that trees are fully as far forward there at two years old as they could be here at three.

The greatest rubber pest in G. E. A. is pig, and heavily barbed wire has been found necessary to fence the properties, while some employ hunters. White ants are also very destructive and will attack trees four or five years old, completely ruining them.

The labour question is not without its difficulties even in G. E. A. where boys are rather scarce. These are brought down from the interior by agents who receive 14 rupees per boy for expenses and for procuring them. The boy signs on for six months and is paid at the rate of 12 rupees per month, but labour is not plentiful. It is usual to have a headman in charge of each gang of fifty boys, and in some instances I found that Malays were employed for that purpose. They seem active and intelligent, accustomed to plantation work in their own country. A weeder's daily task is 1,000 square yards in light grass and 600 yards in heavy. Roughly the cost per acre is estimated at 160 rupees for three year old trees. The quantity constituting a day's gathering is one lb. including the putting on of solution, tapping, etc. If a man brings in more than his pound of moist rubber he is credited with the difference against his month's work or paid at the same rate for the excess. Thus, if he brings in two pounds daily his month's work is completed in about a fortnight, and he can knock off if he chooses for the balance of the month. Should he continue at his work and bring in 2 lbs. each day he receives two month's pay instead of one. It is quite a common thing for a man to bring in 1½ to 2 lbs. per day when he becomes expert at the operation. If after a fair experience a man does not come up to his pound per day he is not considered suitable for that work.

I had some interesting discussion over "Dichotoma," the most recent variety of Manihot from Brazil. The Germans do not favour the enthusiasm with which it has been received in some places. They have had it for the last two years, and the seeds gathered from these young trees have thrown back in size to be little larger than Glaziovii. Whether it is that this variety does not thrive away from its native home, the fact remains that it threatens to deteriorate very rapidly in G.E.A., and the question is would it be any better suited for B.E.A.?

EDIBLE PRODUCTS.

THE STATE OF THE NUTMEG INDUSTRY.

(From the *Agricultural News*, Vol. IX., No. 206, Barbados, March 19, 1910.)

The Imperial Department of Agriculture has recently received enquiries as to the prospects of disposing of the essential and expressed oils of nutmeg at remunerative rates. In response to these, information has been obtained which is of more general value, and the bulk of it is therefore published here.

Firstly, as regards the demand for West Indian nutmegs in the United States of America, the position is summarized in the following article which appeared in the *Spice Mill* for November, 1908, p. 677 :—

Although the ordinary consumer in this country (U.S.A.) never heard of, or purchased, British West Indies nutmegs under their name, still those articles are being sold to them, mixed up with Singapore nutmegs. Owing to the small demand in the United States for the British West Indies nutmegs, because of their inferior quality, the importations are exceedingly light, amounting to about 2,000 barrels per annum. The nutmegs are shipped principally from Grenada (which island is the heaviest producer of the entire group of the British West Indies) to London, England. There they are graded as to size, and mixed with Singapore nutmegs, and then shipped to this market and sold under the trade name of Singapore nutmegs, according to size and quality.

The total production of the nutmegs in the British West Indies is so small that it is not taken into consideration in the preparation of statistics here or abroad. Not until the quality of British West Indies nutmegs is improved by cultivation can they be sold under their real name.

Attention is also drawn to a translation of an article bearing on the subject generally from *De Indische Mercuur*, which appears in the next number of the *Spice Mill* (December, 1908, pp. 749-50). The chief conclusions, due to Dr Treub, Director of the Botanic Gardens, Buitenzorg, Java, reached in this, are :—

(1.) That the price obtained for nutmegs has been declining, with large fluctuations, for many years. This is shown in the following table, which gives the prices, per ½ kilo, obtained in Amsterdam for 110's to 115's in cents, for Banda nutmegs, since 1898 :—

	Highest.	Lowest.	Average.
1898	95	80	86
1899	84	78	81
1900	80	80	80
1901	65	57	60
1902	78	55	64
1903	86	76	81
1904	63	50	55
1905	50	43	46
1906	55	43	48
1907	43	36	39

(2.) It is difficult to trace the real cause of the lower prices. It is not entirely due to overproduction, as is shown by the following table, giving the total export (from official statistics) during the same years, from the Dutch East Indies, which are the principal producers of the article :—

	Kilos.
1898-9	1,889,772
1899-1900	2,670,431
1900-1	2,861,518
1901-2	2,391,072
1902-3	2,840,304
1903-4	2,686,399
1904-5	3,389,804
1905-6	2,793,090

(3.) It is suggested that the fall in value of the product is due to a smaller demand, consequent on a decreased consumption *per capita*,

(4.) In considering any possible effects of increased production, the exports from Java cannot have had much influence on the result. This is shown by the table below, compiled from the statistics of the Handelsvereeniging (Commercial Society) of Batavia, Java, which shows the share of that island in the total export from the Dutch East Indies. It should be compared with the table that has just been given :—

	Kilos.
1902	99,000
1903	82,375
1904	199,200
1905	174,200
1906	182,200
1907	147,500

(5.) As far as nutmeg tallow (or nutmeg soap) is concerned, it appears that this is only used in the drug trade and, to a certain extent, in the manufacture of perfumery. It is not likely that the fall in price of this, in harmony with that of nutmegs, would lead to such an increased demand as to react in the direction of raising the market value of the nutmegs.

(6.) The field for nutmegs as a spice is much larger than that as a material for the oil. Even if the nutmeg tallow (obtained from the oil) could be used on a larger scale, for manufacturing soap, the price paid would be too low to make it profitable to grow nutmegs.

(7.) In view of the fact that the demand for nutmegs is not greater, and that there does not seem to be any prospect of its increase, Dr. Treub recommends that growers in Java should not enlarge the area under cultivation, but that they should replace the plant by another crop as soon as possible.

In their Semi-Annual Report, dated October, 1909, Messrs. Schimmel & Co. say :—

Nutmeg oil remains unchanged at low prices. There has been no lack of cheap nutmegs suitable for distilling, and occasionally exquisite material could be found at ridiculously low prices. All those interested in the article are advised, when requiring large parcels, to ask us for special quotations.

To return to the nutmeg itself, an account is given in the *Revue des Cultures Coloniales*, Vol. XXV., pp. 343-4, of the way in which it is prepared for export at Djati Roengge, Java, from which the following is translated :—

Preparation of the crop for export is very simple. The mace is carefully removed from the 'seed,' in order to prevent the growth of moulds, and then the latter is washed in brine. Drying is conducted in sunshine, or by means of drier, as quickly as possible. The nuts, separated from the shell, are rolled in slacked lime and then packed in cases, the interior of which is coated with lime; these cases measure 45 × 45 × 45 centimetres (1 foot 6 inches each way), and are each capable of holding 60 kilogrammes (about 132 lbs.) of nutmegs. The mace is packed in unlined cases, which are lined with paper. These measure 61 × 61 × 61 centimetres (about 10 feet 0½ inch each way), and each also holds about 60 kilogrammes. These measurements are the ones preferred by the importers at Amsterdam. The cases are strengthened by means of iron bands or iron wire. The treatment of the nuts with lime is for the purpose of preserving them from a boring beetle called 'boeback,' At Banda, they are sometimes smoked for the same purpose, though this does not appear to be necessary. The nutmegs are graded into nine kinds, and the mace into four kinds.

In dealing with the question as to the advisability of expressing the oil (fat) from the nuts for shipment, careful experiments are required for the purpose of ascertaining what proportion of the oil can be extracted. To approach the question theoretically, on consulting various authorities, it was found that the average proportion of oil that can be expressed from the powdered nuts, with the aid of heat, is about 25 per cent. of the weight of the material pressed. A barrel of nutmegs weighs approximately 165 lbs., so that this quantity would yield about 41 lbs. of oil. As far as the essential oil is concerned, according to Gildemeister and Hoffmann's *Volatile Oils*, the amount of oil obtained by distilling nutmegs varies from 8 to 15 per cent. of the weight of the material taken. Allowing a simple average of 10 per cent., this would give 16½ lb. of essential oil from one barrel of nuts.

In considering, however, the advisability of placing the oils on the market, the chief matter of serious import is that, as is shown above, there is only a very limited demand for either of them.

CONSUMPTION OF CACAO, COFFEE, AND TEA.

(From the *Tropenflanzer*, April, 1910. Abstracted by J. C. Willis.)

Detailed figures in kilograms. (1 kilo = 2¼ lbs.) are given for all the principal countries, from which we take the following :—

		Cacao.	Coffee.	Tea.
Germany	1899	18,271,800	156,137,300	2,958,900
	1909	40,724,800	213,483,400	4,961,200
America	1899	15,980,563	379,900,000	32,776,000
	1909	53,378,775	410,000,000	45,000,000
France	1899	17,656,374	81,448,000	885,000
	1909	23,254,200	107,134,700	1,223,300
England	1899	14,775,400	13,100,000	104,200,000
	1909	24,264,112	13,700,000	128,000,000

Increases in consumption are enormously larger in Germany and America than in France and England, amounting in all to 71 and 82 million kilos against 32 and 34.

THE COPRA EXPORTS OF THE DUTCH INDIES.

A note in the *Tropenflanzer* for April gives these for 1908 as 229,491 metric tons, those of Ceylon for the same period being 33,994 metric tons.

CINNAMON IN CEYLON.

(From the *Ceylon Independent*, 13th May, 1910.)

Many of the Chaliyas (Sinhalese caste of cinnamon-peelers) from the neighbourhood of Galle were accustomed, while prices were good, to migrate at a certain

period of the year to the Central Province to cut cinnamon in the forests, generally contracting with the planters for the produce where growing on private properties. In Ceylon the principal and only cultivated species is distinguished above all others by the Sinhalese name of *peni kurundu*, which signifies honey or sweet cinnamon; the second variety is *naya kurundu*, or snake cinnamon; the third *kapuru kurundu*, or camphor cinnamon; the fourth *kahata kurundu*, or astringent cinnamon; the fifth *sevel kurundu*, or mucilaginous cinnamon; the sixth *davul kurundu*, or flat or drum cinnamon; the seventh *nika kurundu*, or wild cinnamon; and the eighth, *mal kurundu*, or bloom or flower cinnamon. Whatever doubt there may have existed with regard to other products grown in Ceylon, there is none whatever about cinnamon being indigenous to Ceylon, for large trees are scattered through the oldest forests of the interior. The island has been famous for its spice from the commencement of historical records. The Dutch under Governor Falk, first commenced the systematic cultivation of cinnamon in 1767-70. In 1506, the Portuguese found cinnamon only in its wild state, but the Sinhalese king who lived in Cotta contracted to pay an annual tribute of 250,000 lbs. of cinnamon in return for the protection of the Portuguese; 3,000 lbs. of pepper and cinnamon was the present sent by the Kandyan King to the King of Holland in A.D. 1602. At one time the most important article from India was cinnamon, which (according to a writer) sold for £8 sterling per lb. in Rome. The "Odours of the far-famed cinnamon spice" came by a poetical liberty to be associated with "Araby the blest." Cinnamon bushes over a hundred years old in Ceylon still bear good crops, and the same soil has grown cinnamon for perhaps over 2,000 years. The Romans communicated with India once a year in the time of Augustus, investing the equivalent of £403,000 sterling in the trade, and calculating the profit at 100 per cent. The first gardens opened in cinnamon were by the Dutch in the year 1767. They formed the Kadirana, Ekela, and Maradana garden between Colombo and Negombo as well as the Moratuwa and Beruwala gardens, covering altogether 15,000 acres, together with gardens near Galle and Matara. The best soil for cinnamon is said to be composed mainly (up to 90 per cent. of pure silica) of snowy white siliceous sand (deposited, probably, from fresh water lakes), or near the sea-coast a little south of Colombo, around the City, and northwards to Negombo. Bark of a fair quality is sometimes got from jungle bushes in the hill districts, and some time ago cinnamon was planted not only by the natives but by European coffee planters in Dumbara, Hantane, Nilambe, Dolosbage, Matale and other districts. The average yield of cinnamon is from 100 to 125 lb. per acre. Really fine cinnamon Ceylon only can produce in perfection, and the great market for cinnamon used to be found in Southern Europe, chiefly in Spain and Italy. In all Roman Catholic countries, a good deal is used for incense purpose, while still more is worked up in the manufacture of chocolate, for which Spain is specially famous.

W. O. A.

Mannar, April 21.

AGRICULTURAL HISTORY AND UTILITY OF THE CULTIVATED AROIDS.* II.

(From the *U. S. Department of Agriculture* Bulletin No. 164, February, 1910.)

There can be no question as to the importance of the cultivated aroids. Though a large number of varieties, and even distinct species and genera, are included under this general term, the series may be viewed agriculturally as a single crop of world-wide importance. It is unfortunate that the studies reported upon by Mr. Barrett could not be carried farther, but even this incomplete report contains a very much wider range of information than any other publication on the subject.

The culture of the taro extends from the West Indies across the Pacific Islands, Japan, China, the Malay region, Hindustan, Madagascar, and the whole breadth of tropical Africa. The natives of East Africa grow the taro extensively and have many named varieties. Welwitsch reports Colocasia as growing spontaneously in the Portuguese colony of Angola, even in districts where it is not now used by the natives. The taro exists also amongst the natives of the interior of Liberia, though the eddoes (Xanthosoma), introduced from the West Indies in the last century, are now preferred.

The scientific name Colocasia has been connected through the Greek with an ancient Egyptian word "culcas." The

* Everywhere grown by natives under the names Kidaran, Gahala (taro), Rata-ala, Habarala, &c.

taro is cultivated in Egypt, but its antiquity in that country was questioned by De Candolle, who also doubted whether "culcas" was really the name of the plant that we now call Colocasia. I have recently learned from Mr. A. Aaronsohn that the taro is grown in Palestine and Syria, especially in the vicinity of Beirut, and that the word "culcas" is still in use among the Arabs as the name of the plant. Mr. Aaronsohn is also inclined to believe that the culture of the taro in Palestine is very old. The culture of the taro in China is considered by all authorities as very ancient. The Chinese residents of California import considerable quantities of taro from Canton and from Hawaii, and are beginning to produce it in California. There is also said to be a growing demand for it among the white population. Whether the taro also existed in ancient America and thus had a really world-wide distribution in prehistoric times is an interesting question worthy of a careful investigation from the standpoint of ethnology as well as from that of the agricultural study of the varieties. The fact that these cultivated aroids have been so persistently neglected by Europeans lends them an especial interest in the study of primitive agriculture, since we have much greater justification for supposing that their distribution represents the work of primitive man than in the case of plants in which civilised people have been interested. The present tendency to give more careful consideration to such plants and to exchange varieties between remote parts of the world is likely to disturb the present localisation of varieties and make it even more difficult to learn their source unless careful studies of the varieties accompany the work of introduction.

There seems to be no record of an introduction of the taro into America by Europeans until very recent times, and yet botanists have reported it as existing in many localities among the natives. The close external similarity of the taro to the yautia renders it very probable that mistakes would be made and prevents our placing any complete reliance upon the reports, even of acknowledged authorities, unless we can know the facts on which their identifications were based. Thus Seemann, who was an eminent and thoroughly competent botanist, reported the existence of Colocasia in Panama with the native name otò, while Mr. Barrett reckons the otó as one of the varieties of Xanthosoma. Varieties having leaves with a closed sinus are reckoned as Colocasia, those with a completely margined open sinus as Alocasia, those with the margin interrupted in the sinus as Xanthosoma. These leaf characters are certainly very convenient in dealing with these varieties that seldom or never flower, but it has to be admitted that such differences are often found among members of the same genus in other groups of plants. The forms reckoned as Xanthosoma appear to be more different among themselves than some of them are from varieties placed in Colocasia. Thus the Palma yautia is very distinct from the other Porto Rican varieties. Its failure to produce timbers, ready production of flowers and greater similarity to a species that grows wild in Central America indicate a more recent domestication.

Varieties of aroids with the taro-like leaves are widely distributed among the natives of the West Indies and adjacent parts of the continent, although not nearly so popular in cultivation as many of the varieties of Xanthosoma. In Porto Rico and Cuba the taro retains the supposedly indigenous name "malanga," which would hardly be the case if it had been introduced by the Spaniards. If the natives of the Caribbean region considered it superior to Xanthosoma, it might be thought to have spread amongst them since the discovery, but it is more difficult to understand the wide distribution without popularity, unless we suppose that the taro was formerly more popular than at present and is being displaced by Xanthosoma. If the taro was not already in America before the arrival of Europeans, it seems more likely to have been introduced from Africa than from the Pacific islands. Importers of slaves from Africa found it to their advantage to supply the negroes with their accustomed foods. The African oil palm and the cola nut, as well as certain varieties of sweet potatoes and yams, are supposed to have been established in the West Indies during the period of the slave trade. The name "malanga" itself is similar to many African words. One of the East African names of the taro is "malombo."

If it be true, as Mr. Barrett seems to think, that Alocasia as well as Colocasia has numerous American varieties, it becomes reasonable to suppose that the three principal types of cultivated aroids, Xanthosoma, Colocasia, and Alocasia, were originally domesticated in America. The American nativity of Xanthosoma has not been questioned, but the greater importance of Colocasia and Alocasia among the Polynesians has made it appear that they

must have originated in the Pacific islands or the Malay region. The same argument has been applied to the coconut palm, which is certainly a native of America, though it has usually been ascribed to the shores of the Pacific and Indian oceans because of its much greater importance in the East Indies than in the West.

The domestication of root crops characterised an early epoch in the development of primitive agriculture in tropical America. This is shown by the large series of root crops that were domesticated in America. In addition to the cultivated aroids, there were sweet-potatoes (Ipomœa), arrowroot (Maranta), cassava (Manihot), yams (*Dioscorea alata*), apio (Arracacia), Ileren (Calathæa), potatoes (*Solanum tuberosum, S. commersoni*, and other species), ullucus (*Ullucus tuberosus*), achira (*Canna edulis*), masna (*Tropœolum tuberosum*), oca (*Oxalis crenata*), and the Jerusalem artichoke (*Helianthus tuberosus*). The yam bean or jicama (Pachyrizus) and the chayote (Chayota or Sechium) were also grown as root crops, though propagated from seeds.

In addition to this series of plants that have become known as root crops and are usually mentioned as such in botanical works of reference, there are records of several other species that are planted as root crops in South America. A list of these has been collected recently by Prof. H. Pittier, of the Bureau of Plant Industry, including *Polymnia edulis, Lepidium meyenii, Portulaca grandiflora*, and several other plants whose botanical names and agricultural possibilities are still unknown.

The root crops that were domesticated in America stand in distinct contrast with Old World root crops, both in number and in character. The species cultivated in the Old World were relatively few, mostly the seed-propagated garden vegetables of temperate regions, such as radishes, turnips, beets, parsnips, carrots, etc. The temperate root crops domesticated in the Old World were mostly capable of being eaten raw, as though they had been used first by people unaccustomed to use fire for cooking vegetables. The root crops that were domesticated in America are not eaten raw by the natives. Many of them are disagreeably acrid in the raw state like the aroids, or even positively poisonous like the cassava. Very few new types of plants appear to have been domesticated as root crops in the Old World Tropics, and none of them have attained the prominence of several of the American species. The banana appears to have been domesticated first as a root crop, and some of the varieties are still cultivated for their root-stocks in New California and in East Africa.

The greater antiquity of the domestication of plants in America is to be inferred from the fact that many of the cultivated species are not known in the wild state, while in the Old World there are very few species, if any, that do not have wild representatives that still appear closely similar to the domesticated forms. In the case of the yautias the American nativity is clearly indicated by the wild species of Xanthosoma. One of these grows abundantly in Guatemala, and is eaten by the natives in times of scarcity of other food. Yautias are also cultivated in Guatemala, but rather sparingly, Indian corn being the chief staple in all parts of the country. The varieties of Xanthosoma cultivated in Guatemala appear quite distinct from the common wild species. The wild plant is larger and has a lighter green foliage, and the root-stocks that provide for the vegetative propagation of the plant are very slender, only about the diameter of an ordinary lead pencil, instead of the large, fleshy, tuberous root-stocks produced by the cultivated sorts. This wild species has a considerable similarity to the variety cultivated in Porto Rico under the name "yautia palma," but has a shorter and thicker spadix with a less ample spathe.

The abundance of the wild Xanthosomas in the mountainous parts of Guatemala, including the volcanic districts, makes it easier to understand how a poisonous plant might come to be used and finally protected, propagated, and cultivated by primitive man. The agricultural development would come about very naturally and gradually after the making of the simple discovery that these acrid plants could be eaten after they had been kept for a time in boiling water. This discovery was possible in many places in tropical America in the very early stages of human progress, before cooking utensils were used and even before fire had been definitely adopted by primitive man. Springs of hot water are numerous, and are shown by special abundance of ancient remains to have been centres of population in primitive times. Former association with hot springs is also suggested by the habit of many of the Indians, such as Kekchis of eastern Guatemala, to drink only hot water.

An alternative possibility has to be admitted, that the taro plant, like the

banana, might have been brought to America from the Pacific Islands in prehistoric times, and might have fallen into comparative disuse as the result of the discovery in America of the Xanthosoma, which seems to be a better plant for general agricultural purposes. There is good historical evidence that the banana, which certainly originated in the Old World, had been brought to America before the Spanish conquerors arrived. No such direct testimony is likely to be secured regarding the taro, which attracted relatively little attention from the early historians of Spanish America. We have to rely upon the general considerations that it is not likely to have been brought by the Spaniards, and still less likely to have been adopted by the Indians, who are very slow to take up the cultivation of any new plant unless it appears to have a very distinct advantage. The Polynesian method of cultivating the taro in pools or swamps is not known to be applied to the plant anywhere in America. Mr. David Fairchild, of the Bureau of Plant Industry, states that the Polynesian system of planting the taro in the muddy soils of swamps or artificially flooded places is in use in the island of Madeira, introduced, doubtless, by the natives of the island who have lived in Hawaii. The nearest approach to this system is seen when the plants are scattered along the banks of small streams. Many yautias are raised in Porto Rico on very steep, rocky slopes of mountains, where the soil is very shallow and irrigation is quite out of the question.

Whether or not we agree with Mr. Barrett regarding the prospective commercial importance of the aroids or their profitable cultivation in the United States, the study of them is eminently justified by two practical considerations: (1) that they are extensively used as food by millions of natives of tropical countries, and (2) that they are worthy of more careful consideration by all Europeans who undertake to settle or reside in tropical countries.

The Tropics afford a great variety of fruits, though there are few localities where the traveller's expectations of profusion are realised. But if fruits are usually to be reckoned as scarce, there is often a downright famine of vegetables. Not only on the Isthmus of Panama, but in many other parts of the Tropics where railroad building and other improvements are being attempted by men from Europe and the United States, the deficiency of fresh vegetables is recognised as a practical difficulty which seriously interferes with comfort, health and efficiency.

The Department of Agriculture receives many letters from American residents of tropical countries asking for information and seeds of varieties of temperate vegetables that will grow in the Tropics. In some regions moderate success with a few of the temperate types of vegetables is possible if special care is used and after sufficient experience has been accumulated. Varieties better suited to tropical conditions are being discovered or introduced from other tropical countries. The success of the Chinese gardeners with some of their seeds from Canton shows that their varieties and methods of culture are worthy of our careful consideration.

In many cases the most practical advice that can be given to persons newly established in tropical localities is to study and make use of the indigenous tropical vegetables, of which these yautias, taros, etc., form excellent representatives. These plants will thrive and produce abundantly under extreme tropical conditions where most of our temperate vegetables will refuse to grow, and the others can be expected to produce only the most indifferent results. The acrid substances and milky secretions render the aroids immune to many of the diseases and insect pests that interfere with the cultivation of other kinds of plants that lack such protection,

Propagation by root-stocks is an especial advantage under tropical conditions, since it avoids the difficulties of germinating, transplanting the seedlings, and caring for the plants in their tender early stages. With sufficient water the cultivated aroids may be expected to hold their own with any other crop, and they will also thrive in places too wet for most of our cultivated plants.

The agricultural advantages make it all the more desirable that residents in the Tropics should become thoroughly acquainted with the cultivated aroids. Many people think they have tried the tropical vegtables who have not really done so. It is necessary to learn how to use a new plant, as well as to learn how to grow it, and one must persist until he has had a fair opportunity of testing his own taste. The tendency to condemn any unfamiliar dish is very general, whereas the same flavour that seemed so objectionable at first may appear quite attractive after we have become accustomed to it. This is true of the aroids used as garden vegetables. By people who have

become familiar with yautia or eddoes they are often recommended as better than potatoes. But if one expects too close a similarity he is disappointed. Instead of the soft, mealy, white, bland-tasting "mashed-potato," one finds a much firmer material of a somewhat yellowish or greyish colour and a distinct, slightly nutty flavour. Nobody would be likely to mistake eddo for potato, and if potato were expected eddoes might be a distinct disappointment. But if we give the eddo a fair trial on its own merits, it may hold its own with the potato in our gastronomic affections. We may be surprised to find ourselves as willing to have eddoes served as potatoes, or to find that we miss the eddoes at home as much as we did the potatoes in Africa.

SHIELD BUDDING FOR THE MANGO.

(From the *Agricultural News*, Vol. IX., No. 207, April, 1910.)

In Bulletin No. 20 of the Hawaiian Agricultural Experiment Station, an account is given of the means by which shield budding may be employed in the case of the mango, and the advantages of the method suggest that it is worthy of trial in the West Indies. An illustrated account of the propagation of the mango by patch budding was given in the *Agricultural News*, Vol. III., p. 283. In order to facilitate experiments in shield budding by those who are interested in the subject, the following information has been taken from the bulletin to which reference is made :—

The proposed method is new only in its modifications and in its application to the mango. It is merely shield budding with an inverted T adapted to the peculiarities of the mango. Shield budding is probably one of the oldest, and certainly the most widely practised, of all methods of budding. Ordinary shield budding had been tried on the mango long ago, following the general practice in the selection of bud-wood and stock that governs in the shield budding of citrus fruits, peach, or plum. In this case young bud-wood was used with the leaf still attached, and it was inserted in young wood. It soon became apparent, however, that this method would not work successfully, and it was abandoned, giving place to the patch bud, which was practised with more mature bud-wood and stock. The present method consists in using wood of the same maturity as in patch budding, but adopts the similar device for bringing the bud shield into contact with the stock, and may be known as shield budding with an inverted T incision.

THE STOCK.—Budding by this method has been successfully performed on stocks from an inch to 3 inches in diameter. What the limitations are, on either side of these dimensions, is not known at present. Wood of this size, in seedling trees, may be from two to five years old. It is essential that the stocks be in a thrifty condition and, still more important, that they should be in "flush." If not in this condition, the bark will not readily separate from the stock. It has been found that the best time is when the terminal buds are just opening. Unless the trees are watched carefully, they will pass this stage before the flush is observed. When the young, brown leaves have appeared, it is often too late to bud, and the operation must be postponed until the next flush.

THE BUD-WOOD.—The bud-wood which has been most successfully used is that which has lost most of its leaves, and is turning brown or grey in colour. Such wood is usually about an inch in diameter. It is not necessary in this method of budding that the bud-wood should be in flushing condition, although it may be an advantage to have it so. It should, however, be healthy wood of normal growth.

PREPARATION OF THE STOCK.—The incisions should be made in the stock about six inches in length. At the lower end of this make an incision at right angles to it, with the knife edge pointing upwards at an angle of about 45 degrees with the stock, thus making a curved incision. Insert the sharpened end of the handle of the budding-knife beneath the bark at the junction of these incisions, and push it gently upward, raising the bark so as to make a place for the bud. It is not necessary to push the handle far, but, by gently prying, the bark may be separated from the stock if the latter is in proper condition, without injuring the delicate cells against which the bud shield is to be placed.

PREPARATION OF THE BUD-WOOD.—The bud is now to be removed from the bud-wood. With a rather heavier knife than is generally used for budding, in the right hand, and the bud-wood held firmly in the left, place the blade against the bud-wood with a very slight inclination, and cut so as to make as flat a surface as possible under the bud shield. This bud shield should be about 3 to 3½ inches long, with the bud in the centre. The small portion of wood,

which will thus be taken off with the bud shield, may be removed if it slips readily. If not, it should be left in place. The lower end of the shield is then taken between the thumb and finger, and gently inserted in the incision prepared for it, pushing it up until it is held firmly in place by the surrounding bark.

TYING AND WRAPPING.—The stock must then be tied with raffia or some other soft, but strong, tying material, so as to prevent drying out. The cut surfaces below the actual bud are usually covered with grafting wax, and the whole is then wrapped with a waxed cotton bandage, beginning at the lower part and winding spirally to the top, exposing only the actual bud. This method of wrapping protects the bud and the wound from the access of water. The bud is shaded by a short piece of bandage hung over it and held in place by being laid under the upper strands of the spirally wound bandage.

SUBSEQUENT TREATMENT.—In about three or four weeks, if the bud remains green, the stock should be lopped at a point about 7 inches above the bud. Care should be taken, in thus cutting stock partly off, to avoid splitting downward. It should be made to split upward into that portion of the stock which is to be destroyed. This lopping will serve to force the bud into growth. Many other buds, on the sides of the stock, will start into growth before the new one. These must all be cut off. It has not been found necessary to remove the tying and wrapping material until the bud has made two flushes, and often it is not necessary at all since the raffia is usually beneath the waxed cloth, and the latter naturally expands with the growth of the stock. When the bud has started into growth, the top of the tree may be completely cut off and destroyed. The stump remaining above the bud may be cut off with a sloping cut close to the bud, after the latter has made three or four flushes.

ADVANTAGES OF THE METHOD.—It has been found that buds can be set quite rapidly by this method. In the experience of the writer, five or six buds could be set, by this means, to one by the bud method. Speed may be increased also by the use of unskilled labour in the tying and binding operations. The operator can set the bud and pass on to the next without any danger of its getting out of place before the helper, who immediately follows, ties it.

Perhaps the most important advantage in this method of budding lies in the fact that it may be used successfully when the bud-wood is not in an active growing condition. The most tedious part of patch budding is in removing the bud, and frequently in doing so it will be broken. Further, it is often impossible to get bud-wood of a desired variety in active condition when the stocks are ready to be operated upon.

The method may be applied most advantageously to seedling trees in orchard form when they have become large enough to be operated upon, when the buds should be set only a few inches above the ground. It may also be used in top-working old trees to new varieties.

WORLD'S VANILLA CROPS.

(From the *Chemist and Druggist*, Vol. LXXVI., April, 1910).

Mr. Hermann Mayer, Senior, sends us the following statistics of the 1909-10 Vanilla production :—

	Tons.
Seychelles	10
Bourbon	35
Mexican	70
Comores, Mayotte, etc. ...	40
Madagascar and Nossi-Be ...	25
Mauritius	2
Ceylon, Java, Fiji, Zanzibar, etc.	10
Guadeloupe and Martinique...	15
Tahiti	180
Total (about)	390

This quantity falls 110 tons short of the 1908-09 crop, and as Tahiti shows an increase of 40 tons, the actual deficiency in the finer qualities totals 150 tons, or 40 per cent. on the previous year's yield, which was of full average extent. Prices during the past twelve months have moved in accord with the statistical position, showing an improvement of 30 to 40 per cent. for all varieties except Tahiti. These have profited by the shortage of all other sorts and maintained their value, notwithstanding the larger returns. Only unimportant balances remain in the Colonies, and, as new crops are unlikely to be landed in quantity before November next, statistically the position appears exceptionally sound.

VANILLA CULTURE FOR TROPICAL QUEENSLAND.

BY HOWARD NEWPORT.

(From the *Queensland Agricultural Journal*, Vol. XXIV., Pt. 4, April, 1910.)

The culture of Vanilla offers facilities to the settler in the northern parts of the Agricultural belt of Queensland that

hitherto have been but little availed of. Some twelve or fifteen years ago Vanilla commanded a price so high (25s. to 30s. per lb.) that considerable areas were planted up in various parts of the world, and big money if not actual fortunes were made. The result that history has shown to be inevitable under such circumstances followed—chemists turned their attention to the production by synthesis of an article so much in demand, and by close planting and overbearing, diseased conditions were induced in the plantations. On the evolution of a synthetic product more or less similar or at least usable as a substitute and cheaper, coupled possibly with the dying out of hundreds of thousands of vines—notably in the Seychelles—the price dropped to 3s. to 5s. per lb., and the industry as a whole suffered a considerable set back.

The history of tropical—as well as other—agricultural products of this nature—of a group that may perhaps be called auxiliary rather than primary—also shows us, however, that these things work in cycles, and that Nature generally comes out ahead in the end. It is, then, for the tropical agriculturist to follow the trend of demand and supply of products such as the one under discussion, and be prepared to take advantage of the fact of an increased demand in the near future.

When the production of a more or less satisfactory substitute, being synthetically supplied, may prevent a rise in price to the level previously attained, it would seem that a reaction is taking place, and the demand for the natural Vanilla beans or pods is increasing and the price slowly, very slowly, but surely, on the upward grade, good qualities fetching 16s. to 17s. 6d., and the poorer qualities down to 8s.

Some of the special advantages in vanilla culture for tropical Australia lie in the fact of its requiring very little clearing of land. Scrub land *with the trees standing—i.e.*, fairly heavily shaded clearings—are essential.

In this part of Queensland the felling of the heavy scrub often costs 30s. to 40s. per acre, and anything up to another £10 may be expended in clearing it for planting; this is at once eliminated, and the lightest of brushing at a cost of a few shillings per acre substituted for it. The work is light and easy, no digging or ploughing being involved, and can be done by women and children. Vanilla is, in fact, the least troublesome in its culture of almost any agricultural staple.

The returns per acre are high and often very large, and the product is of high value per bulk and not readily perishable, and, therefore, lends itself to cultivation in places that are as yet the more difficult of access and the transport from which of the more bulky staples is a matter of some moment. No diseases are known to exist on Vanilla here, and the climate, soil, and rainfalls are particularly in its favour.

When Vanilla was first introduced into Queeensland it is difficult to say. Mr. L. A. Bernays mentions two varieties having been already introduced into Queensland in his "Cultural Industries" dated 1883, but Baron F. von Mueller omits any reference to the plant in his "Select Extra-tropical Plants," dated 1888, which would seem extraordinary.

The Vanilla of commerce is the dried and prepared pods of several species of climbing orchids. The name "Vanilla" is said to be the diminutive of the Spanish "vaina," a pod. Vanilla is a native of Central and South America, and is cultivated in Mexico, Brazil, Honduras, Guadelope, Reunion, Mauritius, the Seychelles, Java, Tahiti, the S. S. Islands, in Polynesia, &c,

There are eight or more known varieties that produce marketable pods, of which five are found in Mexico. The three best known varieties are *V. planifolia*, *V. sylvatica*, and *V. pompona*. *V. planifolia* produces long, thin pods of great aroma, which, however, require treatment; the pods of *V. sylvatica* are found to split to an undue extent, which reduces the value of the product, and *V. pompona* pods are small and short, another disadvantage in marketing, though these pods may be left on the vine to brown.

V. planifolia is the best variety for cultivation, and as it is of this variety only that plants, or rather cuttings, can be obtained in this country, the following cultural notes, unless otherwise specified, may be taken as alluding to this species only.

The Vanilla vine is of exceedingly handsome habit of growth, and, like most orchids, is a true epiphyte, so that while requiring a support—a living tree by preference—to grow on, it obtains none of its nutriments from that tree. As a plant it is curious in that neither the flowers, leaves, nor pods in the green state have any scent, and give no idea, therefore, of the fine aroma and flavour that are developed on the pods being cured; in that its flowers are very rarely fertilised by natural means; and also in that, though an orchid, to thrive it must have connection with the ground. At

first the cuttings must be planted in the ground, but as it ascends its support it is not unusual for the original stem to shrink and die away at the ground end. This in no way adversely affects the plant, however, as it has meanwhile sent down ærial rootlets which, on reaching the ground, become independent subterranean sources of supply of plant food; nevertheless, the greater part of its nutriment is obtained from the atmosphere by means of its thick fleshy leaves and tendrils or ærial roots. Like all orchids heat, moisture, and shade are essential to its successful culture.

SOIL, CLIMATE, AND RAINFALL.

Vanilla requires a rich vegetable soil and a well-drained situation. Sandy soils are too light, do not hold enough moisture, even though shaded, and require manuring; while clay soils hold too much water and are too heavy.

Any of the ordinary scrub soils of Northern Queensland having a foot or more of rich leaf mould are just what the Vanilla vine likes best. In climate Vanilla seeks hot, moist conditions, with a temperature between 70 degrees and 90 degrees Fahr., which is again what is generally to be found in North Queensland scrubs. In the matter of rainfall from 50 to 60 up to 200 or more inches per annum is required, the nearer the average is to the 100 the better, and, if possible, a locality having a well-distributed rainfall for nine or ten months in the year, and two fairly dry months—viz., August to October—is a material advantage.

LAY, ASPECT, AND SITUATION.

In selecting a site for a plantation in this country fairly level land may be chosen. A gentle slope is an advantage in preventing the lodging of storm water and insuring surface, and probably also subsoil, drainage. Gently undulating country will do, but the steeper slopes as well as the low-lying hollows should be avoided. Vanilla is a very soft-bodied plant, and, though it wants moisture, it abhors stagnation—so much is this to be avoided that, in some countries, beds 6 in. to 1 ft. high; and in a circle of 4 ft. or so in diameter round the supporting tree, are often made by a ring of stones filled in with leaf mould to make sure that water cannot accumulate and stand round the roots—the stones are said to afford the roots protection and keep them cool too. This, however, will not generally be necessary in Queensland. Wind is another enemy of Vanilla, especially where the thick vines are draped in curtains over the supports and can swing and break. A westerly aspect may be chosen on this account, though this point is governed by the amount of natural protection to be found on the weather side of the clearing or plantation. Almost any situation may be chosen with the one exception of too great proximity to the sea; salt air is harmful, keeping the vines poor and stunted.

CLEARING, SHADE, AND SUPPORTS.

Having selected the site, the next matter to bear in mind is that Vanilla is planted in the open, and special shade trees grown at stated intervals for its accommodation; this, however, is risky, more costly, involves delay, and is unnecessary here.

The standing scrub supplies all the essentials, and, as before stated, requires but a brushing. The shade necessary is not dense, but chequered. With too much shade in this country it has been found that the vine grows luxuriantly, but will not bear, and with too little the reverse happens. Where very dense only the big trees may, therefore, be left, and in lighter scrub saplings of even 4 in. to 6 in. in diameter are retained. When cleared 250 to 300 trees left standing to the acre, which afford both shade and support, would be about right.

Humus being an essential, it is highly inadvisable to burn off any brush; if possible, it is better to pull it into heaps and let it rot.

As the vines grow they must be kept within reach. They grow quickly, and the natural tendency is to run up the trees to great heights. When this happens the vines are pulled down and draped over supports fastened between the trees, 4 ft. to 6 ft. above the ground. These supports should be hardwood, round by preference, and of 3 in. to 4 in. in diameter, and may be spiked to the trees. If the trees are fairly hardwood, though wooden spikes 12 in. to 18 in. long, and about 1 in. diameter, may be driven into auger holes in the trunks at about the same height, and the vines draped on these. In soft woods like candle-nut these soon perish, however, and let the vine fall, or possibly even kill the tree. Wire is cheap, easily erected, and fairly lasting, but forms too sharp a bend for the fleshy vines, which are apt to break or be frayed in two if swinging in the wind.

Two No. 8 wires 4 in. to 6 in. apart strung from tree to tree may be the best alternative if wooden bars are not available, or the trees are too uniformly soft to carry spikes, but even then pieces of bark or old sacking should be put between the vine and the wire, as the acid

in the sap in time causes even galvanised wire to rust, damaging the plant, and ultimately causing the wire to break.

The clearing is now ready for planting, and, if well brushed, should only require going over with a brush knife once a year or so. Chipping or weeding is unnecessary if properly shaded, and is detrimental as tending to disturb and damage the delicate roots which are so near the surface as to be barely in the ground at all. A carpet of dead leaves is what is wanted.

Plants and Planting.

Vanilla is usually and is best propagated by cuttings. Plants can be raised by seed, but the process is troublesome, rather intricate, and takes about a year longer. The seed is very minute, and if seedlings are required the seed should be washed in soap-suds, mixed with fine sand, dried, and carefully sown in prepared soil in a specially protected situation—a bush-house or glass germinating house by preference. Cuttings, however, are generally obtainable. In such places as the Seychelles, where plenty are available, these cost from 4*s.* to 6*s.* 8*d.* per 100, but here may cost anything up to 6*d.* each. Cuttings of 6 ft. length are best, but if plants are urgently needed may be sub-divided into lengths of not less than three eyes.

The best time to plant is at the beginning of the wet season about Christmas time, or soon after, when full advantage of the rain can be taken. September plantings—if planting weather obtains—save a lot of time, but with so soft and fleshy a plant as Vanilla, watering must generally be resorted to in October and November, or many will be lost. With fortunate weather a September planting may save a year in bringing a field into bearing, but is risky.

The planting is done by digging a shallow trench some 2 in. deep and wide in the soil at the base of the tree trunks, laying therein a portion of the vine from which the leaves have been carefully cut off, pressing leaf mould on top and covering or mulching it with dead and rotting leaves and vegetable matter. This accomplished, the rest of the vine is laid vertically against the tree and tied there by some soft material sufficiently broad not to cut the soft Vanilla. Two plants should be planted against each tree, or if large, with no other trees near it, three. The length of the trench depends on the length of cutting—for 6 ft. lengths three to four nodes or eyes, and for three-knot lengths one eye, may be put into the ground.

The vines grow quickly, and if good seasons are experienced some crop will be obtained in the second year after planting. Usually it takes three years, however, and the plantation gradually increases in productivity as the vines increase in length, and are draped round the trees on the pegs or between them on the rails set for them in thick and somewhat untidy-looking festoons. A plantation will last thirty or forty years, possibly more, and is not considered in full bearing till six or seven years old.

If 250 tree trunks are left standing and two cuttings are set to each, 500 plants will be absorbed in the acre—more or less may be planted—there is no hard-and-fast rule for this method of planting in virgin scrub land, but more implies rather dense shade, so less would be the more advisable.

Manuring and Pruning.

The Vanilla crop is said to be to some extent an exhausting one, though this is usually only noticeable in plantations where the shade trees are especially grown, the soil is deficient in humus to start with, and the moist and humid conditions so much liked by Vanilla do not exist, and it has to rely for nutriment mostly on the soil.

Usually the radius within which the roots of any one vine extend is quite small—3 ft. or 4 ft. at most—so that in virgin scrub land, with a good surface of leaf mould, manuring should not be required for many years, if at all. For sick vines in exposed situations or overbearing plants the only manure required is *humus*, which is best supplied by an armful of leaf mould and dead leaves. Artificial manures should be avoided, and especially animal matter of any kind.

No pruning is necessary either under normal conditions. Under conditions of too heavy shade or too heavy wet and cloudy weather just before blossoming time—about September—sometimes the nipping off of the growing tips will induce the production of flower spikes. Otherwise the only operation of this nature is the careful pulling down of vines that have run up a tree trunk and draping it within reach—also done about September—*i.e.*, before the blossoming. The operation has to be somewhat carefully done, as the vines break easily, and is best accomplished by two persons with long, thin forked sticks

like clothes props, one working the fork up between the vine and the tree, carefully disengaging the tendrils, and the other catching the loose vine in the fork of his stick and lowering it gently down.

FLOWERING.

In the second year a few flowers may be seen, enough to study and practice on, but not enough to count on as a crop. By the third year, however, commencing here, early in October, and lasting till the end of November or later, a large proportion of the vines should produce flowers, which they will do by sending out fat, bright green buds in the axils of the leaves here and there, seldom in two consecutive eyes, which will grow only an inch or two in length before bursting into clusters of buds. One cluster to a yard or so of vine is a good flowering. In a few days the first flowers of the cluster will open, and it will continue slowly developing and opening blossoms for some times two months or more. This flowering is the most interesting if not the most anxious time for growers.

FERTILISING OR POLLINATING.

The Vanilla blossom while having the male and female organ in the same flower is of such construction that it cannot fertilise itself. The insects that fertilise Vanilla do not exist here, or indeed, in most countries where Vanilla is produced commercially. Even where they do exist—the wild forests of Mexico—the proportion of flowers so fertilised is very small. Each blossom has, therefore, to be artificially fructified or fertilised. Considering that each vine may produce hundreds and a plantation thousands of flowers, and it takes roughly—allowing for failures—some 150 or 200 such fertilisations to give 1 lb. of Vanilla beans, the work might appear appallingly great. As a matter of fact, it is very simple and quickly done. So simple is it that children can do it easily and so rapidly that hundreds (experiment at Kameruuga has shown about 1,000) can be fertilised in a forenoon.

While the process is simple, it must be thoroughly understood to be carried out successfully. The best way is to get a flower and pull it to pieces with this descripiton and the illustrations in front of you.

The tool necessary is a little piece of stick—bamboo splinter or toothpick—some 3 in. long and ⅛ in. wide, and quite thin and flat. A pin hammered out flat at the point and the head-cut off stuck into a piece of pencil for a handle makes an excellent fertilising tool.

When examined this flower will be found to have only one thin petal which has any colour on it (and not much of that); when this is gently torn away it is found to be growing from the sides of and protecting a white or pale-green rigid little column with a knobbed top. This carries the male and female organs, and any damage to it must be carefully avoided. The tube to the stigma or ovary has two lips at the top end, the upper one longer than the lower one forming a flap or lid; above this is the male or pollen-bearing part hanging over as though on a hinge at the top of a column. The process of fertilisation or pollination as it is generally called consists of taking the flower between the thumb and second finger of the left hand with the forefinger at the back of the top of the little column, placing the fertilising tool sideways flat against the front of the column and gently lifting it.

First, the lower lip is lifted, or rather both are lifted together; then the lower one, being shorter, slips from under the tool, leaving the aperture open. The pollen glands are then lifted, and the upper lip, which prevents the pollen falling in naturally, is forced behind them, and the pollen glands fall forward again. Now, care must be taken not to raise the tool any further, or the part containing the pollen is cut off. At this juncture the flower is held between the fertilising tool and the first finger of the left hand, the left thumb is then gently pressed on top of the pollen masses, pressing them on to the stigma, where they stick, while the tool is withdrawn sideways, and the pollination is complete.

The vine blossoms in Queensland between September and November. Each cluster consists of some fifteen to twenty flowers, which open successively at the rate of not more than three, and generally only one, a day. These flowers remain open only the one day, and pollination is difficult as well as most uncertain once the flower has begun to wither. It is necessary, therefore, to go round the plantation every day in the flowering season, round every vine, and to each cluster, once it has begun to open its blossoms. The pollinating is best done in the forenoon, from sunrise to noon or not later than about 2 p.m.

In this time a good worker may pollinate 1,000 flowers; it would be a fairly large plantation to average 1,000

blossoms a day, and in a plantation such as might with success be opened in Queensland and pollinating could be finished in an hour or two each morning.

The success or otherwise of the fertilising operation can be seen by the second or at latest third day. When the blossom opens the stalk of the flower, which is really the embryo pod, is seen to be a bright green colour. If the pollination has been successful this retains its colour, begins to swell perceptibly by the second day, while the blossom itself fades as quickly, but does not fall off, sometimes adhering to the quickly growing pod for a month or more. If the operation on the other hand has not been successful, the embryo bean turns a yellow colour, does not swell, and the blossom usually falls off within three days, sometimes at once. The pollinating is frequently left entirely to women and girls in other countries, and is light and easy enough work for them in this country.

PRICKLY PEAR AS FODDER.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 2, February, 1909.)

The "prickly pears" belong to an extensive genus widely distributed in America and the West Indies. Many of the species have been introduced into Southern Europe, Africa, Australia, and elsewhere for the sake of their edible fruits, and also owing to their utility as hedge plants. All the species are more or less fleshy, especially while young, and most of them are armed with strong sharp spines.

The plants are available in large quantities in many countries, and in some of the Australian colonies have become a pest, so that some method of utilising them is highly desirable. The composition of the plants indicates that they should be fairly nutritious as feeding-stuffs for cattle, but a serious objection to their use as a fodder is the presence of the spines, which are not readily rendered innocuous.

A *résumé* of the methods available for this purpose, and a large number of analyses of prickly pear plants as grown in the Southern States are given in two *Bulletins* of the Bureau of Plant Industry (Nos. 74 and 102, Part I.) published recently by the United States Department of Agriculture.

The chemical composition shows that the feeding value of these cacti compares favourably with those of ordinary green fodders and root crops. Although the "cane cacti" have a higher feeding value than prickly pear, practical considerations relating to growth and ease of propagation render them of less value than the latter, except where they are naturally abundant.

With the exception of *Cereus giganteus* and *Echinocactus Orcuttii* and a few other rare species, the genus Opuntia supplies the material mostly utilised for fodder, and it is the flat-jointed forms which are principally employed in America. There are about five species in the cylindrical-jointed group which have been used with some success, namely, *O. imbricata* from Mexico, *O. arborescens*, *O. fulgida*, and *O. prolifera* from the coastal regions of Southern California. Of these, probably the most valuable are *O. fulgida* and *O. imbricata*.

Opinions regarding the value of prickly pear as a fodder are very conflicting; but it appears to be generally regarded in the United States as best suited for use with richer material, such as bran cotton-seed meal.

Various methods for rendering the spines innocuous are employed in the several cactus regions. The most common practice consists in singeing the spines over a bush fire, or in a less primitive manner by the use of a gasoline blast flame, such as is used by plumbers. A more efficient method, and one said to be used in Australia, is boiling or, preferably, steaming the prickly pear for several hours, thereby rendering the spines harmless. Chopping machines are also employed in Texas, the object in this case being to cut the prickly pear into such small pieces that the spines are made innocuous by abrasion. In New South Wales it is considered that the most practicable method is the conversion of the material into ensilage, since after a few months the spines become quite soft, and the ensilage is said to be both nutritious and palatable.

Experiments conducted in California have shown that by selection and crossing of cactus plants it is possible to produce a spineless variety valuable as a pasture plant and having a feeding value about equal to that of lucerne

MISCELLANEOUS PRODUCTS.

BAOBAB TREES USED FOR STORAGE OF WATER.

(From the *Kew Bulletin*, No. 3, 1910.)

Sir Joseph Hooker has called our attention to an account of the manner in which the natives of Kordofan form reservoirs for rain water in the trunks of living Baobab trees (*Adansonia digita*). The paper by Capt. Watkins Lloyd, late Governor of Kordofan, Soudan, from which the following extract is taken is published in the Geographical Journal, March, 1910, pp. 253-254, with an illustration of the tree on p. 251. The country referred to lies to the west of El Obeid.

"Elsewhere the people are dependent on water-melons and the water they store in baobab trees. The melons are small and almost tasteless, and are grown in enormous quantities amongst the corn. When ripe they are collected in heaps and protected from the sun until required for use.

"The baobab trees have to be carefully prepared for use as reservoirs. The large branches are first cut off near the trunk. If this is not done, the trunk is apt to split as soon as it is hollowed out. Round the bottom of the tree a shallow basin some 20 or 30 feet in diameter is made, in which the rain-water collects. As soon as there is a storm, the people go out and fill their trees. The water so stored remains perfectly good until the end of the next hot weather, or even longer. A few trees, naturally hollow, have a hole at the top between the branches, and fill themselves, the branches catching the water and acting gutters. These are called "lagai" and are highly valued by the Hamara.

"The Arabs did not invent this method of storing water, but improved on the system of their predecessors, who made the hole in the trunk only 10 or 12 feet from the ground. The present system gives a cistern 20 feet high and from 8 to 10 feet, or even more in diameter. Owing to the labour involved in preparing and filling the trees, water is usually bought and sold, and on the main roads where there is much traffic, as between Nahud and Jebel el Hilla on the way to El Fasher, the capital of Darfur, the people do a regular trade by supplying merchants and travellers with water.

"The bucket, called a 'dilwa,' used by the Arabs deserves mention. It consists of a piece of leather suspended by strings 6 inches long from a piece of wood bent in a circle, to which the rope used for drawing the water is fastened by three or four strings. On reaching the bottom of the well the leather opens out and collects the water, however little there may be."

Though this appears to be the first reference by an English geographer to the process of hollowing out the trunks of Baobab trees so as to serve as reservoirs, it is not the earliest record of the practise of storing water in this fashion in Kordofan. We are indebted to Captain H. G. Lyons, R.E., F.R.S., for having called our attention to a passage in Mr. J. Petherick's account of Egypt, the Soudan and Central Africa, published in 1861. At pp. 208, 209, Petherick says of the Baobab:—"Its trunk and even branches, for the most part hollow, are of immense size, the diameter of the former attaining as much as 40 feet. . . . .

"These trees, in many parts of the country where water is scarce, form highly valuable natural tanks, and when filled by the rains are carefully preserved and tapped by the natives during the drought, and enable them to inhabit parts of the country which otherwise, for want of water, would be untenable."

HISTORY OF THE SEA COCOA-NUT (*LODOICEA SECHELLARUM*, LABILL.)

By E. BLATTER, S. J.

(From the *Journal of the Bombay Natural History Society*, Vol. XIX., No. 4, 28th February, 1910.)

There is scarcely any other palm which has been so little known and was yet the most celebrated formerly as the Sea Cocoa-nut or Double Coco-nut. The French call it Coco de mer, Coco de Salomon, and Coco des Maldives, and it was known to the writers of the 16th and 17th centuries under the names of Nux Medica and Cocos Maldivicus. Before the exploration of the Seychelles in 1743, by order of Mahe de la Bourdonnais, then Governor of Mauritius, the nuts were only known from having been found floating on the surface of the Indian Ocean, and near the Maldive Islands, whence their French name was derived, and even in the time of Rumphius the nut was spoken of as

the "mirum miraculam naturæ, quod principes est omnium marinarum rerum, quæ raræ habentur."

The first European who described this famous fruit was the Portuguese Garcia d'Orta (Garcia ab Horto). He was physician to the Viceroy at Goa for about thirty years. In this capacity he found leisure for private study which he spent in the exploration and description of the useful plants and drugs of the country. In 1563 he published the results of his investigations in his Coloquios da India," which were soon translated into several modern languages, and into Latin by Clusius in the year 1567. This work went through many editions, and it is in the one of 1605 that we read the following account of the "Coccus de Maldivia." This nut, especially the kernel, are recommended by the inhabitants of the islands (Maldive Islands) as a remedy against poison. I have been told by many trustworthy people that it proved useful in colic, paralysis, epilepsy, and other nervous diseases, and that the sick become immune against other diseases if they drink water that has been kept in the shell for some time, and to which has been added a piece of the kernel. But as I have no personal experience I am not inclined to believe in these things. I had no time to make experiments, and I prefer to use medicaments whose virtues are known to me and shown by experience, as, *e.g.*, the bezoar stone, theriac, and many other medicines than new ones which are less reliable, because I do not know whether I have to ascribe to imagination only what people say about the beneficent effects of that nut. If, however, in the course of time, some facts will be verified, I shall not feel ashamed to change my opinion. The skin of the nut is black and smoother than that of the common Cocoa-nut, mostly ovate and not quite as round as the common nut. The kernel or inner pulp is hard and white when dry, sometimes slightly pallescent, full of cracks and very porous. The dose of the kernel is about 10 grains, taken in wine or water, according to the nature of the disease. The nuts are sometimes very large, sometimes small, but they are always found thrown upon the shore. There is, besides, the common opinion that the Maldive Islands formed once part of a continent which by an inundation of the sea disappeared, those islands alone being left; the palms, however, that produced those nuts, were buried underground, and the nuts themselves became petrified in the way we find them now. Whether those palms belong to the same genus as our nut is difficult to say, as nobody up to now was able to see either the leaves or the stem of that plant. Only the nuts are washed ashore, sometimes in pairs, sometimes single; but nobody is allowed to collect them on penalty of death, because everything that is carried ashore belongs to the king. This circumstance has added a good deal to the value of these nuts. The pulp or medulla is then removed and dried in the same manner as our "Copra," till it becomes hard like the one you see in the market. In this condition you might easily mistake it for cheese." To this account Clusius adds the following note: "I have seen vessels made of this nut in Lisbon as well as in other places; they are usually more oblong and darker than those made of the common Cocoa-nut. You can even find the dried medulla of the nut in the market of Lisbon; its virtues are highly praised, and it is preferred to almost all other alexipharmics. For this reason it is sold very dear. But you can easily gather from our author how little faith such fabulous virtues deserve."

Whilst Garcia d'Orta was staying at Goa, a Spaniard, Christobal da Costa (Christophorus a Costa), of the medical profession, left his home with the only desire to "observe and study the various plants which God had created for the benefit of the man in the different countries and provinces." On his tour he came to Goa where he met his colleague Garcia d'Orta. From the personal intercourse with him as well as from d'Orta's book he received most of the information which some time after was published in Spanish and translated into Latin by Clusius in the year 1572. Regarding the Sea Coco-nut we read in his book: "The, 'Coccus de Malediva' is in such high esteem with the natives of that Island and with the people of Malabar, not only with the lower classes but also with kings and princes, that in all sickness they confide in that fruit as in a sacred anchor. They make of it drinking cups in which there is a piece of the kernel hanging from a small chain, and they are strongly convinced that whosoever has drunk water from such a cup, is immune against every poison and disease. I saw, however, a good many that drank from those cups and fell sick nevertheless. In spite of many careful observations I never noticed that anybody was cured by such a drink. Some even assured me that after a draught from such a cup the spleen and kidneys got inflamed. The price of these nuts is, nevertheless, very great,

a single nut without any ornaments being sold for 50 and more gold pieces."

The fame of the Sea Cocoa-nut was so great in the 16th century that it found a place in Camœns' famous epic (X 136).

"Nas ilhas da Maldiva nace a pranta
No profundo das aguas soberana
Cujo pomo contra o veneno urgente
He tido por antidoto excellente."

"O'er lone Maldivia's islets grows the plant,
Beneath profoundest seas, of sovereign might,
Whose pome of ev'ry Theriack is confest,
By cunning leech of antidotes the best." (Burton).

Another account of the Sea Coco-nut and description of the Maldive Islands we find in the "Itinerario" of John Huyghen Van Linschoten (1596), who had spent five years (1584-89) in Goa, and had seen a great part of Eastern Asia. The following quotation is taken from the edition of the "Hakluyt Society": "Right over against the Cape of Comariin, 60 miles into the sea westward, the Islands called Maldyva doe begin, and from this cape on the north side they lie under 7 degrees, and so reach south-east, till they come under 3 degrees, on the south side, which is 140 miles. Some say there are 11,000 islands, but it is certainly known, they cannot be numbered. The Inhabitants are like the Malabares: some of these Islands are inhabited, and some not inhabited, for they are very lowe, like the countrie of Cochin, Cranagnor, etc., and some of them are so lowe, that they are commonlie covered with the sea: the Malabares say, that those Islands in time past did ioyne past unto the firme land of Malabar, so that the Sea in process of tyme hath eaten them away. There is no merchandize to be had in them;, but only coquen, which are Indian nuttes; and cayro which are the shelles of the same nuts, and that is the Indian hemp, whereof they make ropes, cables, and other such like. . . . . There are some of these nuttes in the said Island that are more esteemed then all the nuttes in India, for that they are good against all poyson, which are varie faire and great and blackish: I saw some that were presented unto the viceroy of India, as great as a vessel of 2 canes measure, and cost above 300 Pardawen which were to send unto the King of Spaine. Of this tree and her fruites, together with the usage thereof I will discourse more at large in the declaring of the Indian trees and fruits."

We are looking in vain for a more detailed description of the fruit in the II volume of the Itinerario, where a great number of plants are described.

The best account of the Maldives is that by François Pyrard who was shipwrecked there in 1601. His description contains also the following short note on the Double-Cocoa-nut: "The King has, besides his revenues, certain rights, *e.g.*, everything that is found on the seashore belongs to the king, and nobody has the courage to touch anything of the kind in order to keep it, but all must bring what they find to the king, whether it be a piece of a wrecked ship, pieces of wood, a box or other things carried to the shore. The same obtains with regard to a certain nut which is sometimes washed ashore. It has the size of a man's head and can be compared with two large melons grown together. People call it Tavarcarre, and they believe that it comes from a tree growing at the bottom of the sea. The Portuguese call it "cocoa des Maldives." It has medicinal properties and carries a high price. Very often on account of this Tavarcarres, the servants and officers of the kind maltreat a poor man if he is suspected of having found such a nut; if somebody wants to take revenge on his neighbour he accuses him of having a nut in his possession, in order that his house may be searched, and if anybody becomes rich on a sudden and within a short time people begin to say that he found a Tavarcarre, as if this were a great treasure."

More credulous than Clusius and D'Orta as regards the wonderful properties of the Sea Cocoa-nut is Willam Piso, a Dutch physician, who had travelled in Brazil between 1636 and 1641, and who, by his writings added considerably to the scientific knowledge of the West Indies. He devotes a whole chapter written in elegant Latin to the "Nux Medica Maldivensium." He first of all excuses himself, because he gives the figure of the fruit only instead of the whole plant; but nobody, he says, can expect the illustration of a plant which has been devoured by the sea and is now growing at a depth of 16 fathoms. The introduction of the chapter gives a vivid idea of the high esteem in which the Sea Coco-nut was held for centuries, and at the same time, of the way in which scientific subjects were treated 300 years ago. It runs as follows: "Amongst the immense benefits which the Divine Providence has showered upon mankind during the last centuries, one of the most valuable is the discovery of so many medicaments des-

tined for the protection of the human race, because after the welfare of the soul, the health of the human body takes the first place. With regard to the invention of the iron machines, of which our present age is boasting so much, I should rather say that they are for the ruin of the nations than for their welfare. Also the art of printing, though it may be specially fit for the preservation of the literary monuments, only favours the bad zeal (kakozelia) of unable scribblers. Similarly, there is no reason why we should be proud of the booty of the Aerythræan Sea or of the gold mines of the Atlantis, because, according to the highminded poet the yellow metal is more dangerous than the iron.

Jamque nocens ferrum, ferroque nocentius aurum
Prodierat; prodit bellum, quod pugnat utroque.
(*Ovidius Metamorphoses primo.*)

But the glory, of the European Argonauts can never be too loudly sung; they have discovered a new continent which was hidden for centuries, they have unveiled the secrets of the sea and shown the way to so many islands scattered in the Indian Ocean. By their efforts it came out that almost

Omnis ferat omnia tellus,

and that foreign medicaments of high and rare value were introduced into our country. Amongst them the Sea Cocoa nut (*Nux Medica Maldiviensis*) occupies the first and foremost rank, whether we consider its rareness or its prize and value, or finally its usefulness that was ever praised."

As to the origin of the nut Piso gives two opinions. The common people say that it grows on trees that are hidden in the sea, or which were covered with water at the time of an inundation, or that had their roots in the water as their natural medium. The more devout hold a different view. They believe that the nut grows on an island called Pallayas, which is invisible to those who want to find it, and visible to others that do not know about it. From that island the nuts are carried away by the ocean-currents and washed upon the shores of the Maldives. The inhabitants of the Maldive Islands believe that Pallayas is the happiest of all the countries of the world, and that the devils and malicious genii want to hide it before the eyes of man.

Piso relates that Rudolf II, Emperor of Germany, offered 4,000 florins for a Sea Coco-nut, but the family of Wolfered in whose possession the nut was, was not inclined to part with it. In the Maldivian Islands the value of one nut was estimated at from 60-120 crowns; but those which measured as much in breadth as in length were the most esteemed; and those which attained a foot in diameter, were sold for 150 crowns; some kings have even been so greedy of obtaining these fruits as to have given a loaded ship for a single one.

We can easily understand the great desire of many of becoming the happy owner of such a nut, if we read the long catalogue of cases drawn up by Piso, in which the Nux Medica is said to have played such an important part in the restoration of the diseased to their former health. We cannot refrain from reproducing in this place for the benefit of the "sons of Æsculapius" at least two of the many medical prescriptions which were believed in and followed in the 16th and 17th centuries:—

In Peste et Febribus malignis Contagiosis.

Cocci Maldivensis ʒj. Seminis Acetosæ mundati ʒj. Syrupi e succo Granatorum acidorum, aut Scabiosæ, aut florum Tunicæ, ʒj, Discordii, Fracastorii ʒj. Decocti radicum Petasitidis, Scordii et Scorzoneræ, aut aquarum Boraginis, Buglossæ q, s. F. Potio.

In dysenteria cruenta, et Torminibus: facta ante præparatione debita per Rheum et Clysteres.

Corticis intermedii Nucis Medicæ ʒj (si desit, Medulla aut Putamen vicem suppleat). Terræ Lemniæ, Lapidis. Bezoartici, Orientalis et Bistortæ radicis ana ʒj. Syr. de succo Portulacæ parum, and consistentiam, Bol. F. et insuper adjectis requisitis, Conditum, potio, et similia.

The most complete historical account of the Sea Coco-nut we find in Rumphius (Herbarium Amboinese, VI, 210) who describes the marvellous fruit under the Dutch name "Calappa Laut." The stories are fabulous enough, but in addition to it he tells us, that many other tales were related to him respecting it, too absurd to be repeated. The Malay and Chinese sailors used to affirm that it was born upon a tree deep under water, which was similar to the Coco-nut tree, and was visible in placid bays, upon the coast of Sumatra, but that if they sought to dive after the tree, it instantly disappeared. The Negro priests declared it grew near the island of Java, where its leaves and branches rose above the water, and in which a monstrous bird, or griffin had its habitation, whence it used to sally

forth nightly, and tear to pieces elephants, tigers, and rhinoceroces with its beak, the flesh of which it carried to its nest. Furthermore they avouched that ships were attracted by the waves which surrounded this tree, and there retained, the mariners falling a prey to this savage bird, so that the inhabitants of the Indian Archipelago always carefully avoided that spot. Rumphius thinks that the Chinese as well as the natives of the Archipelago have set, perhaps, too high a value upon the medical properties of the nut, considering it an antidote to all poisons. The principal virtue resided in the meat or albumen, which lines the nut, and which is so hard and corneous, as to be preserved for a length of time after the embryo is destroyed. This substance is triturated with water in vessels of porphyry, and mingled with black and white, or red coral, ebony, and stags' horns, was all drunk together. The great men formed of the shell which possesses fewer medical properties, precious vessels, cutting off a transverse slice, which constitutes the lid; in this they put their tobacco, betel, lime and whatever else they masticate believing they can never then be contaminated by anything noxious.

With the discovery of the Seychelles in 1743, a new period began for the Sea Coco-nut, the object of so many legends and superstitions. La Bourdonnias was the first to discover the tree on one of the Seychelles Islands. He called it "Isle of Palms, now known by the name of "Praslin." Later on the tree was also found on Curieuse and Round Island. These are within half a mile of each other, mountainous and rocky. Plant, the well-known explorer of Port Natal, tells us in what surroundings this noble palm is growing; "In the Seychelles," he says, "I more nearly realized my preconceived ideas of tropical vegetation than at any other place;—the beach fringed with common Coco-nuts; the ravines and water-courses overhung with Bananas, Bamboos, the open ground full of Pineapples—miles of them run wild; the tops of the mountains covered with forests of Ebony and Rosewood, interspersed with Tree-ferns of some 20-30 feet high, and then these glorious Lodoiceæ, with their leaves of fifteen to twenty feet span, and trunks reaching to the sky; to say nothing of the groves of Cinnamon Cloves and Bread-fruit, all new to me in this their natural wildness and beauty." Harrison is not less enthusiastic when he remarks: "To behold these trees growing in thousands, close to each other, the sexes intermingled; a numerous offspring starting up on all sides, sheltered by the parent plants;—the old ones fallen into the sear and yellow leaf and going fast to decay to make room for the young trees, presents to the eye a picture so mild and pleasing, that it is difficult not to look upon them as animated subjects, capable of enjoyment, and sensible of their condition."

Although the tree had been discovered at last, it still took a long time before it was accurately described. Pierre Sonnerat gave a description of it, though not a very scientific one, when on his tour to New Guinea he landed upon the Isle des Palmiers (Praslin). He was the first to introduce the tree into the Isle of France.

The description given by Rochon does not add any new information. It is, however, interesting to hear, that it was not uncommon as late as 1759 to see the nuts sold for upwards of four hundred pounds sterling each.

After this several botanists described the palm under different names: Gmelin called it *Cocos maldivica*, Giseke, *Borassus sonnerati*, Commerson, *Lodoicea Callipyge* and *Cocos maritima*, Persoon *Lodoicea maldivica*. At last La Billardiere was able to give a botanical description of it under its present name *Lodoicea sechellarum*, to which he added figures from specimens preserved in spirits, together with a representation of the tree from a drawing made in the Seychelles Islands by M. Lilet. The description is followed by an account of the uses of the Palm, communicated to the Museum of Natural History at Paris, by M. Queau-Quincy, Correspondent et Administrateur General des Isles Seychelles. The description, however, was still deficient in many points, and it was to be expected that a botanist like W. J. Hooker could find no rest before he had found out everything about that interesting tree.

"These accounts of la Billardiere" he writes in 1827 "in conjunction with some nuts that Mr. Barclay and myself received from our inestimable friend and correspondent, Charles Telfair, Esq., of the Mauritius, only served to stimulate our curiosity; and we requested Mr. Telfair, to procure, if possible, either from the palms that he informed us were cultivated in the Isle of France, or from the Seychelles Islands, such specimens as would enable us to publish more satisfactory delineations than had yet appeared. The Isle of France Palms had not yet fructified; but Mr. Telfair lost no time in begging his

friend J. Harrison, Esq., of the Seychelles, to obtain the necessary specimens. With the utmost promptitude and kindness that gentleman devoted several days to visiting, with a dozen of blacks, the Isles of Praslin and Curieuse; and in the midst of those little known islands, he not only made drawings from the living trees, but procured and forwarded to us, through Mr. Telfair, the male and female spadices and fruit, in different states, preserved in spirits, with leaves, a seedling plant and even a portion of the trunk. All these, except the fully ripened fruit, arrived in safety. A perfect representation, therefore, of the mature nut, is still wanting."

This want has been supplied, in the meantime, by various botanists, and the once so mysterious Sea Coconut tree is as well known as any other plant. We are not going to give a detailed description of the tree, as we are only concerned with its history, but we must mention a few points of interest regarding its life-history and economic uses.

This magnificent palm requires a great length of time to arrive at maturity. The shortest period before it puts forth its flower-buds is 30 years, and 130 years elapse before it attains its full growth. From the age of 15-25 years it is in its greatest beauty, the leaves at this period being much longer than they are later on. The stem grows quite upright, straight as an iron pillar, and in the male trees frequently attains a hundred feet in height, the females being shorter. At the age of thirty it first puts forth its blossoms, the males forming enormous catkins about 3 ft. in length, and 3 inches in diameter, while the females are set on a strong zigzag stalk, from which hang four or five, or sometimes as many as eleven nuts, averaging about 40 lbs. weight each. From the time of flowering to the maturation of the fruit, a period of nearly 10 years elapse, the full size, however, being attained in about 4 years, at which time it is soft and full of semi-transparent jelly-like substance. The arrangements provided by nature for the roots of this tree, are of a most peculiar kind. The base of the stem is rounded, and fits into a natural bowl or socket about 2½ feet in diameter and 18 inches in depth. This bowl is pierced with hundreds of small oval holes about the size of a thimble, with hollow tubes corresponding on the outside, through which the roots penetrate the ground on all sides, never, however becoming attached to the bowl, their partial elasticity affording an almost imperceptible but very necessary "play" to the parent stem when struggling against the force of violent gales. This bowl is of the same substance as the shell of the nut, only much thicker; it rots very slowly, for it has been found quite perfect and entire in every respect 60 years after the tree has been cut down.

The crown of the trunk, *i.e.*, the heart of the leaves is eaten like that of the American cabbage palm (*Oreodoxa regia*), and often preserved in vinegar; but it is less delicate and slightly bitter. The trunk itself after being split and cleared of its soft fibrous part within, serves to make water troughs, as well as palisades for surrounding houses and gardens. The foliage is employed to thatch the roofs of houses and sheds, and even for the walls. With a hundred leaves a commodious dwelling may be constructed, including even the partitions of the apartments, the doors and windows. The down which is attached to the young leaves serves for filling mattresses and pillows. Of the ribs of the leaves and fibres of the petiole they make baskets and brooms. The young foliage affords an excellent material for huts: for this purpose, the unexpanded leaves only are taken, dried in the sun, and cut into longitudinal strips, 2 or 3 lines in breath, which are then plaited. Of the nut are made vessels of different forms and uses. When preserved whole and perforated in one or two places the shell serves to carry water. Plates, dishes and drinking cups made of the nuts are valuable from their great strength and durability, so that this kind of utensil in the Seychelles Islands bears the name of "Vaiselle de l'Isle Praslin." Amongst other articles, shaving dishes, black, beautifully polished, set in silver and carved, are made from them.

The marvellous medicinal properties which were ascribed to the nuts by ancient physicians, both European and Asiatic, have been recognised as fanciful nowadays and depends solely on the rarity of the fruit. It is consequently no longer valued by Europeans but it is (according to Dymock) still in great repute among the Arabs and natives of India as a tonic preservative and alexipharmic. Ainslie relates that in his time the Vytians occasionally prescribed the kernel given in woman's milk in cases of typhus fever, the dose being "a quarter of a pagoda weight twice daily," and adds "it is also reputed antiscorbutic and antivenereal." Dymock mentions that in Bombay it is prescribed as a tonic and febrifuge in combination with *Lignum colubrinum* (the small branches of *Strychnos colubrina*, L.)

It is also believed to possess several other properties. "Daryali-naryal" says S.A. Ravat, "is corrupted in Bombay into Jehari-naryal which means 'poisonous Coconut,' and it is believed to be so by the common people. It is, however, non-poisonous, and is commonly given to children, mixed with the root of Nux vomica, for colic. It seems to act mechanically, like Bismuth." Rubbed up with water, it is given by natives to check diarrhoea and vomiting, especially in cholera. Some believed that the water of the green fruits or its soft kernel is antibilious and antacid when taken after meals.

It is to be regretted that the tree is not cultivated, and that a practice has prevailed of cutting it down in order to get at the fruit and tender leaves, and it is to be feared that this will lead to the extinction of the Sea Coconut, which will become in reality as rare as it was supposed to be by the travellers who picked up the first known specimens of its nuts floating on the sea.

THE UTILISATION OF EUCALYPTUS LEAVES.

(From the *Indian Trade Journal*, Vol. XIV., No. 177, August 19, 1909.)

There are many places in Australia where eucalyptus oil is distilled for medicinal purposes, and there is said to be an establishment in New South Wales where acetic acid is an important by-product in the distillation of the oil. It is, however, at Fort Esperance—about fifty miles distant by water from Hobart—that the eucalyptus oil itself is considered merely a by-product in the preparation of the more valuable extract for use in preventing deterioration of boilers. This extract has the appearance and consistency of tar when prepared for export to England. It is shipped with no more liquid in it than is necessary to prevent caking in the casks *en route*, it being thinned, however, on its arrival. The extract is said to diffuse itself through the water of boilers and cleanse them of any acid, greasy or saline matter, forming with such deleterious ingredients a harmless sediment which sinks to the bottom, and it prevents any formation of crust round the water-line. The American Consul at Hobart says that four tons of eucalyptus leaves will produce one ton of the extract for boilers, and about seventy or eighty pounds of eucalyptus oil. Twigs of the leaves are taken off the trees irrespective of the age or height of the tree, except that old tress are not preferred owing to the great preponderance of woody matter. They are placed in large bags, and, by an iron hook arrangement, are carried down the hill-side along wires specially strung for their easy transportation to the mill. The leaves are for the most part about ten inches long, and from an inch to an inch and a half wide. The leaves mostly used at the establishment referred to above are taken from an underbrush of trees in "bush" destroyed by fire about two years ago. The same trees may be considered good for another crop of satisfactory leaves in about three years after the first leaves have gone to the mill. The leaves are placed in a large cauldron, called a digester, and steam is applied for four hours. During this steaming the acetic acid in the leaves passes out as vapour, the eucalyptus oil is carried by the steam to the condenser, the waste water being separated by the use of a syphon. The residuum in the digester is then subjected to steam presure, by means of which the valuable extract is obtained, being first, however, boiled down to the consistency of tar. The woody matter which is left in the digester after the oil and extract have been taken out is then removed, and burned as refuse. In order to prevent the digesters being eaten by the action of the acetic acid in the leaves they are painted with the extract before the leaves are put in and the steam applied. Some experiments have recently been made at Port Esperance to ascertain if varieties of eucalyptus leaves, other than the blue gums, could be used for the production of both boiler extract and eucalyptus oil and as a result it appears that practically every variety of eucalyptus leaf will furnish the boiler extract, but that the best quality of eucalyptus oil by-product is obtained from the blue gum. The stringy bark contains more of the extract, but less of the oil than the blue gum. The local consumption of eucalyptus oil for medicinal purposes is very large. There are other uses to which, it is said, eucalyptus can be put, although there has, as yet, been no practical demonstration of such uses in Tasmania. An illuminant, known as "gum gas," can be produced from the leaves, and is said to give a bright light. An Australian authority has estimated that 10,000 feet of gas can be obtained from a ton of leaves. The eucalyptus bark is said to contain a fibre suitable for paper, and eucalyptus woods are considered valuable for many purposes.

PLANT SANITATION.

PLANT DISEASES.

(From the *Gardeners' Chronicle*, Vol. XLVII., March 26, 1910.)

So much activity has been devoted in recent years to the investigation of fungal diseases of plants that a new work from the pen of an authority on the subject is most welcome.

It is true that we have in this country the treatises by Mr. Massee, which serve as excellent introductions to the study of plant diseases; nevertheless, we have lacked, hitherto, a text-book which would serve for the student who has passed beyond the elementary stage, and is embarking on a more advanced course. This lack is now supplied by Professor Duggar's new volume in the American Country Life Series.*

The study of plant diseases is, up to a certain point, so easy and straightforward that anyone with a microscope and a little patience can pursue it. The spores produced by most parasitic fungi are of definite shapes, sizes and patterns, and hence, by comparing their microscopic appearances with the figures in the text-books, the several pests may be identified. But the trouble begins when the fungus suspected of causing mischief is not in the sporing stage. Then, to all but the specialist, the work of identification is well-nigh hopeless, unless means are at hand for keeping the fungus alive under such conditions as are calculated to induce it to form its tell-tale spores.

Hence the student will be particularly grateful to Professor Duggar for having given, in the first part of his book, instructions for the cultivation of fungi in the laboratory. As he points out, the application of bacteriological methods to the cultivation of parasitic fungi is of the highest importance. Nor are these methods difficult of application; with the help provided by Professor Duggar's book, an intelligent student may carry his studies beyond the more empirical stage, which consists in the "running down" of fungi, to a stage in which he is able to control their cultivation and thus gain an insight into their peculiar modes of life.

So important is it that parasitic fungi should be studied in this manner, that we could have wished that Professor Duggar had dealt with "methods" even yet more fully. The information given in the seven chapters which make up Part I (on Culture Methods and Technique) is sound, and includes methods of isolation, preparation of pure cultures, and the technique of microscopical preparations.

Part II. consists of descriptions of parasitic fungi and of the methods whereby they may be kept in check. The perusal of this work demonstrates at once its excellence and the very primitive state of our knowledge with respect to preventive methods. The references to original memoirs, given at the head of each chapter, should prove of considerable service to the student, and must also give him—if, perchance, he is a native of this country—some food for reflection. For although one of the pioneers of plant pathology was the British botanist, Berkeley, of recent years, with three or four distinguished exceptions, our botanists appear to have almost deserted this field of investigation.

This is the more unintelligible, since not only may a study of fungal diseases lead to advances of the greatest practical importance, but it is bound also to advance botanical science no less considerably.

It is hardly an exaggeration to say that our only method of coping with these agents of plant diseases is that of spraying; but spraying, important as is undoubtedly is, cannot be the last word of advice of science to the practical man.

Truth to tell, the ætiology of plant diseases remains in large measure for the future to discover. New methods are required. The enormous progress made in the combating of human diseases—progress which a few years ago the pessimist would have pronounced impossible—encourages us to entertain the conviction that new modes of attacks on fungal pests will be devised.

Is it too much to hope that some of the botanical laboratories of this country will take up, methodically, this promising line of research? In it science and practice meet, and have much ground in common.

But though our perusal of Professor Duggar's book has suggested to us how

* *Fungous Diseases of Plants*, by B. M. Duggar, Professor of Plant Physiology in the New York State College of Agriculture, Cornell University. (Genn & Co., pp. 508. Illustrated. $2·00.

much remains to be done, it also, as we have said, indicates how remarkable has been the progress in some directions in the unravelling of complex life histories of parasitic fungi, such, for instance, as the rusts.

It is indeed a graceful act of reparation that the country which has supplied us with so many mischievous pests should now come to our aid so successfully in the work of mitigating the evils for which they are responsible.

LIVE STOCK.

THE DIGESTIBILITY OF PRICKLY PEAR WHEN FED TO CATTLE.

(*Agricultural News*, VII. 168, October, 1908.)

A pamphlet has lately been issued by the United States Department of Agriculture (*Bulletin 106* of the Bureau of Animal Industry) containing a detailed report on a lengthy series of experiments conducted at the College of Agriculture, New Mexico, in order to test the digestibility of the cacti known as 'prickly pear' (*Opuntia* spp.) when fed, both alone and in conjunction with other foods, to cattle.

Previous bulletins issued by the Department have given analyses showing the chemical composition of a large number of cacti, including prickly pear, but since the value of a material as a food is not determined solely by its composition, it is necessary also to know the percentage digestibility of the nutrients found present by the chemist.

The mode in which the digestion experiments are conducted is simple. First the animal is fed on the feeding stuff for a few days until all other feeds have been removed from the alimentary canal. The animal is then, under suitable conditions, fed with a weighed amount of the feeding stuff, the composition of which is determined by analysis. All the liquid and solid excreta is collected, weighed, and analysed, and the amount of nutrients it is found to contain is subtracted from the amount of the corresponding nutrients fed. In this way the percentage of each constituent digested is ascertained.

The following were among the conclusions arrived at as a result of the experiments :—

The average digestibility of the nutritive constituents of prickly pear (*Opuntia* spp.), fed alone, were : dry matter, from 63·96 to 65·86 per cent. ; ash, 33·68 to 35·81 per cent. ; albuminoids, 40·87 to 57·47 per cent. ; fat, 68·38 to 69·02 per cent. ; carbohydrates (starches, sugars, etc.), 78·95 to 81·78 per cent., and fibre, 41·32 to 53·99 per cent.

Compared with ordinary green fodder foods, it may be said that the above figures show a somewhat low digestiblity for the albuminoids of prickly pear, a very low digestibility for the ash, but a very good digestibility for the carbohydrates. Taken altogether, the digestibility of the various constituents is about the same as that of immature green maize fodder.

When prickly pear is fed with well-cured fodder, as hay for instance, or oats, cotton-seed meal, etc., the digestibility of both materials is increased. In these cases the prickly pear has a greater food value than the above figures would seem to indicate.

The albuminoid ratio, *i.e.*, the ratio of albuminous, or nitrogenous constituents to carbohydrates, is very low in prickly pear. Hence, much better results will always be obtained when it is fed with some food rich in nitrogenous constituents, as pea, or bean, or cotton-seed meal.

It is suggested that a satisfactory ration for milch cows would consist of 50 lb. of chopped prickly pear, 5 lb. of cotton-seed meal, and a small amount of rough cured fodder, as hay or straw.

BEE-KEEPING IN CEYLON.

As to the productiveness of the indigenous bee (*memessa*) under the best system of culture, the data available are very limited ; but there can be no doubt that the indigenous bee is sufficiently productive to be remunerative. The Italian bee is probably better—it is certainly easier to handle and can be subdued with a single puff of smoke, but beekeeping started with the indigenous bee can be readily extended to the Italian or any other foreign variety. Thanks to Mr. Shanks, the chief engineer of the Harbour Department, who is the Pioneer in this matter, the Italian bee has been successfully introduced and will probably spread to all parts of the Island. As to the quality of the honey and wax produced by the local bee and the imported bee there should

hardly be any difference. The extracted honey of the local bee sells very readily at Re. 1/- a bottle or more. Native doctors prefer the *meemessa* honey to any other in their medicines. The absence of suitable honey plants is the chief difficulty in the successful rearing of introduced bees which, for this reason, have to be artificially fed during the greater part of the year. The introduction of such plants is, therefore, one of the ways in which the industry could be fostered. The Ceylon Agricultural Society has done something in the direction by encouraging the growing of buck-wheat and introducing logwood. An effort should be made, if possible, to select such plants as will produce good fodder or other produce and at the same time serve the purpose of bee plants.

Beyond material profit, the intelligent bee-keeper is rewarded by the intellectual pleasure he derives from the phenomena of bee life, for on those who keep bees the pursuit exercises a fascination few persons can resist. Discarding the fanciful writings on the economy of the hive, there is still infinite interest to be found in it:—the sanitary precautions, the foresight, the division of labour, the courageous self-sacrifice for the common good, the untiring industry and vigilance of the workers, the great regard towards the mother queen (the ruling monarch), and last but not least the extraordinary unity.

By the use of the Benton cage the transport of queens by post, and by means of a nucleus hive of small stocks, is rendered possible. In this way queens or stocks are supplied by apiarists who make a special business of breeding.

As a rule bees vary in appearance with age—young bees are more hairy and when they are just hatched their hair is so light that they have a powdered appearance. Old bees generally lose much of their hair, and the abdomen may be almost bare and shining. Very young bees are slower in their movements and cannot fly, so that if shaken on the ground they cannot rise again, and in this way they often get lost. Young bees are less likely to sting when handled and they receive a strange queen or workers readily where old bees would destroy the former and enter into deadly conflict with the latter.

The number of bees in a hive differs widely with the stock, some being better than others; and it varies with the season and the prolificness of the queen. For want of a natural good supply or owing to incessant rain, a weak stock may be reduced to a few hundred bees; a strong stock at the height of the honey flow may contain 50,000 or more. However, the number of bees in a hive cannot be ascertained until they are counted, and no local bee-keeper appears to have done so yet. Stocks of *Apis indica* admit of being made very strong by artificial feeding. The number of drones may reach thousands if the bees are left to themselves; it varies with the age of the queen and should usually be from a few hundreds up to a couple of thousands during the hot season. Expert opinion is that workers live only seven or eight weeks in a moderate working season and less when hard working, those living through the inactive season live longer than during a honey flow. I have known workers to live over five months in a queenless colony. Naturally drones are hatched during the swarming season and destroyed or worried out of the hive when the swarming is at an end. The performance of the sexual function causes death of the individual drone. In a queenless colony, however, drones are tolerated all throughout. Observation of the treatment of the drones affords the bee-keeper valuable information as to the condition of the colony and to some extent the honey supply. Queens normally live several years; they have been known to lay well up to four or five years of age, and a queen is supposed to be at her best in her second year.

A. P. GOONATILAKE.

Veyangoda, 11th February, 1910.

SCIENTIFIC AGRICULTURE.

THE MULCH.

(From the *Planters' Chronicle*, Vol. V., No. 13, April 1909.)

The motto of modern agronomists should be, "Tilth, mulch and microbes." The most important of these may be microbes, but mulch is a very big word, and one of the greatest of factors in plant economy.

If there is one fundamental principle of plant cultivation that is neglected more than any other, it is unquestionably the artificial protection of roots from heat and dryness dangers.

Tilth has to do with all the major operations of soil manipulation. Microbes, under favourable conditions, attend to the oxidation, nitrification, and other chemical transformations which put crude organic substances into the plant food form; indirectly with the acids "set free" (*sic*) by the decomposition of humus, and possibly by their own toxins and excretory products, they are also concerned with "the break-down" and solution of the mineral elements themselves.

To give these microbes a "square deal," in other words, to keep the soil surface fresh and moist, and at a more or less even temperature, to prevent wind-drying and sun-burning, to give the root-hairs on the feeding roots a chance to take their liquid nourishment in comfort and abundance, we must *mulch*.

It is sad fact that a small per cent. of the producers of vegetable products know, or even care to know, the prime functions and qualities of plant roots, that the very large majority of planters, and even horticulturists, do not use mulches. It is sad because it means an unnecessary and unconscionable loss of probably about 16 per cent. of the normal production of the world's cultivated crops. And, putting the total annual value of all merchantable products of cultivated plants at about £5,000,000,000, doubtless as an under-estimate, the loss from the non-mulch system of the majority of agronomists is a matter of some £800,000,000, at least. It may be argued that this is not lost, that it is "left in the ground;" but this point needs no reply, it merely asks the question whether a *forest* soil would *outlast a bare* soil. Now that the modern farmer has found out that the chemical analysis of soils is a farce, that an array of digits and decimals has but little to do with fertility, that the plant knows more about it than the test-tube, and that chemical fertilisers are not plant foods, a big step forward has been made. But as to the subterranean battlefield where living matter must meet and try to devour the cold, dead grains of one-time rocks—there the question of economy and ecology are left to fight it out. Bacteria and toxins, colloids and enzymes, antibodies, acids, a medley microcosm, all somewhat affected by each, and all more or less successful in breaking down the mineral material into stuff that plants can make their ashes (skeletons) with: these factors, though plainly demanding both air and moisture that the good work may go on, are only too frequently neglected *in toto*; the meaning of the battle, the armies, the weapons, and even the results, are grievously ignored by the average agriculturist.

One-half of the £8,000,000 lost yearly through ignorance and carelessness in attending to crop roots would not only pay for all the Government agricultural appropriations and all the scientific instruction along all the lines of theoretical and applied agronomy in the whole world, but would keep for five years a mulch expert in every farming district, in every country, and establish, on five years subsidies, 1,000 well-equipped institutions for plant growth investigations.

Until recent years the art of farming was ahead of the science; the planter did "thus and so" because certain methods were generally followed with good results. To-day the science, though only glimpsing the new light on the high points of modern agriculture's broad domain, is soaring above and beyond the mere art of plant production. To be sure in some branches of horticulture the art seems more developed than the science; but even there the scientific foundation and framework is being gradually demonstrated. The future oleraculturist will investigate the idiosyncrasy and inherited Mendelian characters of each variety before he puts it out on a large scale. The viticulturists' sons will keep an eye on their "cultures" in the hard-by laboratory.

A square deal for the roots! Protection from their enemies, the venomous grass-root excretions (that can make even a lusty orange-tree sick and choke the vigour out of the best stand of maize), the burning rays of the sun, the deadly soil surface dryness, decent bed and board, *i.e.*, tilth and humus: give them these, and there will certainly be

an increase of hundreds of millions of solid cash which the planters will have to spend.

If mulching were an expensive affair or difficult, there will be more sympathy for the losers. But the dust mulch is of the simplest preparation; the straw, or leaf blanket is, except for the grain crops, almost always possible and profitable, the live mulch, or "cover crop," is the triple-action modern implement which the farmer is beginning to wield very successfully in the soil-food-man war. If roots were only outside, on the top where the easy-going, well-meaning, farmer could see them and note their symptoms and understand them! But, of course, being stuck into the ground, they are just anchors or props, and therefore their comfort—under the even coolness and moistness of a mulch where the microbes can multiply and the humus business hum—their very existence is practically forgotten.

Once on a cacao plantation belonging to one of the well-known English firms the manager ordered a labourer from the dank, insanitary recesses of the sodden "field" to demonstrate to me the good old way of "forking" the surface soil. After an embarrassing *quart de minute*, the perplexed fellow said, "I can't boss; I got no *cutlas*." Such things seem incredible, of course, but one can see only too commonly, the root-murdering method in actual practice just as one may see grass knee-high in coconut nurseries, or scorching hot white sand between the nearly half exposed nuts, which have an *unaccounted for* habit of dying, or at least sulking for years.

To suggest a leguminous live mulch to the more advanced class of agriculturist is to meet with the objection that—"there is only enough moisture, to say nothing of food, in the ground for the *primary crop*, and, besides, the blanket crop would hardly give back its own seed."

The vertical forking method, to let in air and food and break the clamminess of clayey or silty "packed" soils, which was first put before the Agricultural Society of Trinidad and Tobago in 1907, was hailed with gladness by perhaps half-a-dozen cacao planters and put into immediate, if but transitory, practice. . . Give a coconut, orange, tea, or coffee, estate manager a live mulch plant to keep down the grass and weeds and to freshen and enrich the surface soil, then hear him explain that he has long-standing orders to make "not less than three general cleanings per annum," and they must be made on a very generous scale under pain of the suspicious proprietors' criticism.

AN AMERICAN METHOD OF DEVELOPING AGRICULTURE.

(From the *Journal of the Board of Agriculture*, Vol. XVII., No. 1, April 1910).

Great efforts are made by the agricultural colleges in the United States to attract and interest famers in their work. One method, which seems to be increasingly popular, is to bring instruction to the farmer's door by the use of a special train, from which lectures are given at wayside stations. An instance of the use of a train in this way was mentioned in this *Journal* in July last (p. 328), and a similar, but somewht novel, form of giving instruction has recently been tried in Indiana.

The train was supplied without charge by the Erie Railway Company for the Agricultural Experiment Station of Purdue University, Lafayette, which provided the lecturers and exhibits.

The train was composed of three coaches and a double side door horse and carriage car. Lectures of 45 minutes' duration each were given at the stations where the train stopped. The lectures were given in the coaches, which had been fitted up with charts by the University; and the horse and carriage car contained three cows for demonstration purposes.

After a lecture of 30 minutes had been delivered a 15-minute demonstration was given in regard to the cows. When the people had assembled on the platform, one of the doors of the car in which the cows were kept was thrown open, and two Jerseys were shown to the spectators. The general run of the demonstration lecture was as follows:—

"Here you see two Jersey cows. Can anyone say off-hand which is the better? The first cow cost about £10 per annum to feed. She produced £11. 10s. worth of milk or £11 15s. worth of butter fat, so you had about 35s. profit per annum for the pleasure of milking her twice a day. The second cow, another Jersey, is a better producer, and gave £19 worth of milk. This cow also cost £10 per annum to feed, but she showed a much larger profit. We get at the value of these cows by record. Every farmer should keep a record of his cows, the same as every other business man does

of his business and manufacturing costs. The record is the only way to get at the value of cows for dairy purposes."

Pamphlets were then handed round explaining the importance of milk records, and the lecturer continued :—

"There are over 600,000 cows in the State of Indiana. One third of them are of the same type as the first cow shown, so that about 200,000 cows in this State are producing practically no profit at all. These Jersey cows are more suitable for a district where butter is made. You have the great Chicago market for fresh milk before you, and you should see to it that you get cows that will produce plenty of milk."

The second door was then thrown open and a Holstein cow shown, the lecturer continuing :—

"This is a Holstein cow. She cost £2 more per annum to feed than the Jersey cow, or £12. She produced butter fat valued at £17 or milk valued at £38. The milk from a Jersey cow contains a larger percentage of butter fat, but the Holstein is the milk producer for this fresh milk district. This cow, by record, produces over 1,100 gallons of milk per annum, or about ten times her own weight."

From 50 to 200 farmers were present at every station.

At an evening meeting the Railway Industrial Commissioner of Erie, who had accompanied the train, said that he had noticed a wonderful change in the interest taken by these farmers in this train, compared with that taken by them in the first train on milk production, some three years ago. Even when a similar train for improving maize growing went through last spring a great many farmers were too shy to go into the coaches, but this time as soon as the train arrived at the station the farmers rushed into the coaches and took a lively interest in the whole matter.

These trains are provided by the railway companies with the object of developing the agriculture of the district through which their lines run. In this particular case, the railroad company were endeavouring to promote the trade in fresh milk for the Chicago market, by encouraging farmers to keep cows for milk production rather than for butter.

NITRO-BACTERINE.

By T. PETCH, B.A., B.SC.

"It was mentioned in the Heeleaka Report for 1908 that the results which were obtained from the inoculation of the seeds of leguminous green crops with nitro-bacterine previous to use were not such as to warrant any definite recommendations as to its use. In plot experiments inoculated seed certainly grew better than untreated seed, but this was not the case in the majority of field experiments. Discrepancies in the results obtained were probably due to differences in the nature of the soil on which the experiments were made, for this has an important bearing on the subject. It seems desirable, therefore, to renew investigations in this direction with a view to determining whether on certain soils inoculation of green-crop seeds with nitro-bacterine is likely to be economically profitable." The foregoing is quoted from the Programme of the Scientific Department of the Indian Tea Association for 1910. Similar experiments, it is understood, have been carried out in Ceylon, but details have not been published.

The course of these experiments is usually the same. Seed is inoculated according to the directions, and in some cases a control plot is sown with uninoculated seed at the same time. If the inoculated plot shows an advantage, that is attributed to the action of the nitro-bacterine. If it does not, the failure is attributed to some factor in the soil; often the explanation is given that the soil is so rich in nodule-forming bacteria that the nitro-bactrine does not sensibly increase their number.

But such experiments, as a rule, omit the most essential detail. Few of the experiments would use chemical fertilisers without having first obtained a complete analysis, giving the percentage of each constituent to two places of decimals. And even if such analysis were supplied by the vendor, and the mixture was not liable to change, they would obtain a check analysis. Yet nitro-bacterine, though it presumably contains living organisms liable to injury or death, is accepted and used without any bacteriological analysis.

This point has not been overlooked in Europe. Nitro-bacterine has been tested for two successive years at each of two agricultural stations in Germany. In addition to the usual inoculations and crop tests, a bacteriological analysis of the mixture has been made at the same time by competent bacteriologists, accustomed to isolating and identifying nodule-forming bacteria. The result of the analysis has been the same in all cases, viz: that nitro-bacterine does not contain any nodule-forming bacteria. Similar work has been done in Italy with exactly the same result.

Nitro-bacterine, therefore, falls into the same category as Moore's cultures of nodule-forming bacteria. The latter were dried on cotton wool, and distributed by the U. S. Department of Agriculture many years ago. But the distribution was abandoned, because it was impossible to preserve the bacteria in that way, and therefore the cultures were valueless. When nodule-forming bacteria are dried they die, and for that reason nitro-bacterine cannot contain any.

ARTIFICIAL MANURES.

(From the *Madras Agricultural Calendar*, 1909.)

Plants remove certain mineral substances from the soil which they utilise as food, and it is upon the presence of these substances that the fertility of a soil largely depends. The amount of them in the soil is limited, and sooner or later, if no provision is made to replace those removed by the crops, the residual amount of one or móre is insufficient for the needs of the plants, and impoverished crops result. The supply of plant-food in the soil is kept up by adding farm-yard manure or artificial fertilizers or by green-manuring, etc.

Unlike farm-yard manure which supplies all the different kinds of plant-food required in the soil, artificial manures supply only one or at most two of these substances, and it is necessary to make a judicious selection in order to correct the deficiencies in the soil. For example, the application of phosphate to a soil in need of potash would merely result in loss to the cultivator.

Many artificial manures are liable to be washed out of the soil by rain or irrigation water, and others are destroyed by the action of micro-organisims, so that there is great danger of loss if more is supplied to the soil than is necessary. Only that portion of the fertilizer which is recovered in the crops is of value, and the residue must necessarily remain until the next crop is on the ground, representing so much capital which returns no interest. Under these circumstances, the object to be aimed at in applying artificial manures is to supply sufficient food to the soil to satisfy the requirements of the succeeding crop only. In other words it is to feed the crop and not to enrich the soil. A well-chosen artificial fertilizer should act promptly and decisively on the crop to which it is applied.

Artificial fertilizers are spoken of as either "slow" or "quick" acting, according to the length of time over which their effect is felt by succeeding crops. Thus superphosphate is quick-acting and its effects are chiefly felt by the crop immediately following the application, but bone-meal is a slow-acting manure as it only gradually becomes available as plant-food and its effects are felt over several successive years. In this connection it must be remembered that the same amount of plant-food applied in the form of superphosphate or bone-meal has only the same total effects on the crops, and that with bone-meal the only difference being that in the case of bone-meal it is spread over a number of years, during which the capital represented by it is bringing no return and much loss may occur.

Considerable skill is required in the application of artificial manures both as regards time and method, but in this the properties of the fertilizer may be taken as a safe guide. The easily soluble quick-acting manures are preferably applied when there is a prospect of a vigorously growing crop to make use of them. For example, nitrate of soda should never be applied until there is a crop on the ground, as there is great danger of its being washed out of the soil. The same applies to ammoniacal fertilizers, for, although the soil has a strong retentive power for it, it is soon converted into nitrate and washed out. The fact that soil retains ammonia make the application of this preferable to nitrate for wet lands and in wet weather.

Phosphatic and potassic fertilizers are retained by the soil and their time of application may be determined by their convenience; superphosphate, for example, is commonly drilled in with the seed or broadcasted the same day as sowing. Slow-acting manures like bones, basic slag, etc., may be applied many months before sowing.

On light open soils possessing little retentive power it is better to use slightly soluble manures in preference to soluble manures which would easily be washed out.

Artificial manures do not provide any organic matter for the formation of humus and consequently in soils naturally poor in this constituent, like many Indian soils, long continued applications of them lead to a reduction of the humus and a consequent alteration of the condition of the soil. This change may have serious effects on subsequent croppings. Undoubtedly the best method to use artificial manures is in conjunction with bulky organic substances such as

farm-yard manures and poonacs or together with the practice of green-manuring.

Enough has been said to show that the question of the application of suitable artificial manure to cultivated land is by no means a simple one, and moreover certain crops show a preference or dislike for special manures. Any cultivator who is wishful to use artificial manures on his crops is able to obtain the advice gratis of the Department of Agriculture either by communicating with the Director or with the Deputy Directors. Any samples of manure, if forwarded by cultivators to the Agricultural Chemist, will be analysed free of any charge and reported upon.

W. H. HARRISON,

Agricultural Chemist, Coimbatore.

AGRICULTURAL FINANCE AND CO-OPERATION.

THE AGRICULTURAL BANK ACT OF THE PHILIPPINE GOVERNMENT, 1908.

(First Philippine Legislature, Special Session. A. B. No. 240.)

No. 1865.—An Act creating a Government Agricultural Bank ot the Philippine Islands and appropriating for funds thereof the sum of one million pesos.*

By authority of the United States, be it enacted by the Philippine Legislature, that:

Section 1. An agricultural banking corporation, to be known as the "Agricultural Bank of the Philippine Government," is hereby created and established, with its principal office and place of business in the city of Manila.

Sec. 2. The sum of one million pesos is hereby appropriated out of any of the general funds of the Insular Treasury not otherwise appropriated, as and for the capital of said bank.

Sec. 3. The Agricultural Bank of the Philippine Government is hereby authorized to receive deposits of funds of provinces, municipalities, the Postal Savings Bank, societies, corporations, and private persons, and the Postal Savings Bank, and provincial and municipal governments are hereby authorized to make such deposits. Interest to be paid by said bank on deposits so made shall not exceed four per centum per annum.

Sec. 4. The affairs and business of said bank shall be administered by a board of directors, composed of the Secretary of Finance and Justice, and in his absence or in the case of his disability the Acting Secretary of Finance and Justice, the Insular Treasurer, and in his absence or in the case of his disability the Acting Insular Treasurer, and three citizens of the Philippine Islands, or of the United States, resident within the Philippine Islands, who shall be appointed by the Governor-General by and with the advice and consent of the Philippine Commission. The Secretary of Finance and Justice and in his absence or in case of his disability the Acting Secretary of Finance and Justice shall be ex-officio president of the board of directors. Three members of the board of directors shall constitute a quorum at any meeting thereof.

Sec. 5. The Insular Treasurer and in his absence or in case of his disability the Acting Insular Treasurer shall be the manager of said bank, and shall perform the duties of his office in accordance with this Act and the by-laws of said bank duly adopted as hereinafter provided.

The official bond of the Insular Treasurer, and in his absence or in case of his disability that of the Acting Insular Treasurer shall be liable for the faithful performance of the duties of such Insular Treasurer or Acting Insular Treasurer when acting as manager of said bank.

Sec. 6. With the approval of the Governor-General, the Insular Treasurer is authorized to constitute provincial and municipal treasurers agents of said bank, and they shall render such services in the operation of said bank as may be required of them by the Insular Treasurer. When constituted agents of said bank, provincial and municipal treasurers are charged with official responsibility, and their bonds shall be liable for the faithful performance of their duties as such agents and for the safekeeping and accounting for any money or property of said bank confided to their custody.

The Governor-General may, on request of the board of directors of said bank or of the manager thereof, require any

* Rs. 1,500,000.

officer or employee of the Government to perform any service or render any assistance to said bank which he, the said Governor-General may deem proper.

Subject to the Civil Service Act and rules and the by-laws of said bank, the manager of the bank is authorized to appoint such other personnel as may be necessarily required for the proper operation of said bank. The personnel so appointed by the manager of said bank shall perform the duties and shall receive the salaries prescribed in the by-laws.

Sec. 7. The Attorney-General shall be the legal adviser of said bank, and shall render such legal services to said bank as may be required of him by the manager of said bank or by the board of directors thereof. In the performance of his duties, the Attorney-General is authorized to require such services from the provincial fiscals as to him may seem best in the interest of said bank.

Sec. 8. The board of directors is empowered to adopt such by-laws not in conflict with this Act, as may be proper for the prudent and successful operation of said bank, and to amend or repeal the same: *Provided*, That such by-laws, or any amendment or repeal thereof, shall not take effect until the same shall have received the approval of the Governor-General.

Sec. 9. The members of the board of directors, appointed as such by the Governor-General, shall each receive for each day of meeting of the board actually attended the sum of ten pesos.

Sec. 10. The bank may make loans only for the payment or satisfaction of incumbrances on agricultural lands, for the construction of drainage and irrigation works, and for the purchase of fertilizers, agricultural seeds, machinery, implements, and animals, to be used exclusively by the borrower for agricultural purposes, and no loan shall be made by said bank to any person or corporation not engaged in agricultural pursuits.

Sec. 11. No loan shall be made except upon resolution of the board of directors. No person or corporation shall be permitted to borrow less than fifty pesos nor more than twenty-five thousand pesos: *Provided, however*, That fifty per centum of the capital of said bank shall be set apart for loans of not more than five thousand pesos to any one person or corporation.

Sec. 12. No loan shall be made except,

(*a*) Upon the security of a first mortgage on unincumbered, improved urban property or upon unincumbered agricultural land, not to exceed forty per centum of the value thereof. No loan shall be made unless the Attorney-General shall have certified and the board of directors shall be satisfied that the real estate offered as security for the loan is free from all incumbrances, and that the title thereto is in the mortgagor. All mortgages shall contain a covenant requiring the mortgagor to insure for the benefit of the mortgagee all buildings of strong materials on the property to the amount of their value as fixed by the board of directors.

(*b*) Upon the security of a chattel mortgage to the bank on crops already harvested, gathered, and stored: *Provided, however*, That no loan on the security of such crops so harvested, gathered, and stored as aforesaid shall exceed forty per centum of the market value thereof on the date of the loan. The property mortgaged shall be insured by the mortgagor for the benefit of the mortgagee to the full amount of the loan.

Sec. 13. All mortgages on real property and chattel mortgages on harvested, gathered, and stored crops shall be registered with the register of deeds in the jurisdiction where situate, and it shall be the duty of the registrar of deeds to indorse on such real or chattel mortgage, and on his record thereof, the date and hour of its reception, and such registration with the registrar of deeds of such real or chattel mortgage shall be notice to all the world of the lien created by such mortgage and of the terms and conditions thereof. The expenses of registration shall be paid by the borrower.

Sec. 14. The bank shall not exact more than ten per centum per annum on any loan made by it.

Sec. 15. Loans shall not be made for a period exceeding ten years, and may be made payable in instalments as the board of directors may determine in each case.

Sec. 16. No fee or charge of any kind whatsoever by way of commission shall be exacted or paid for granting or obtaining loans, and any official of the bank exacting, demanding, or receiving any fee for service in obtaining a loan or for the use of his influence to obtain a loan shall be punished by imprisonment for not less than one year nor more than five years, in the discretion of the court.

Sec. 17. Within one year after foreclosure sale of property has been accomplished the mortgagor of the property shall have the right to redeem said property from the bank upon payment of the amount found due by the court

in the decree of foreclosure with interest thereon at the rate specified in the mortgage, together with all costs incurred by the bank by reason of the foreclosure and sale and the care of the property.

SEC. 18. The Agricultural banking corporation provided for in this Act shall have the general powers mentioned in section thirteen of "The Corporation Law," which are not in conflict or inconsistent with the provisions of this Act.

SEC. 19. All acts or parts of Acts inconsistent with the provisions of this Act are hereby repealed.

SEC. 20. This Act shall take effect on July first, ninteen hundred and eight.

Enacted, June 18, 1908.

BY-LAWS OF THE AGRICULTURAL BANK OF THE PHILIPPINE GOVERNMENT.

SEC. 1. The principal office and place of business of the Agricultural Bank of the Philippine Government shall be in the office of the Insular Treasurer at Manila.

SEC. 2. The banking hours shall be such hours as shall be fixed by the manager.

SEC. 3. The seal of the Agricultural Bank shall be the seal adopted for the use of the Government of the Philippine Islands, with the additional words "Agricultural Bank" engraved thereon.

BOARD OF DIRECTORS.

SEC. 4. The board of directors, unless notified to the contrary, shall hold a meeting every Monday morning at nine o'clock at the principal office of the bank. Special meetings may be called by direction of the president.

SEC. 5. The board of directors shall appoint a secretary who shall attend all meetings of the board, and shall perform such other duties as may be prescribed by the by-laws.

SEC. 6. No member of the board of directors shall borrow from the bank, nor shall any member act upon any loan in which any relation or business associate is interested.

SEC. 7. No liability shall attach to any member of the board by reason of any loss which the bank may suffer through erroneous appraisement of property, depreciation in value thereof, or fraud either of borrowers or agents of the bank.

SEC. 8. It shall be the duty of the board of directors, whenever an application for loan is submitted to it by the

manager with all the necessary information, to take action thereon within two weeks from the date of submission.

SEC. 9. The board of directors shall observe the following order of business at its meetings:

1. Reading of the minutes of the previous meeting and action thereon.
2. Unfinished business.
3. Reports of committees.
4. Reports of the manager of the bank.
5. Applications for loans and action thereon.
6. New business.
7. Adjournment.

This order of business may be changed at any meeting of the board upon the unanimous consent of all members present.

SEC. 10. The minutes of all meetings of the board of directors shall be signed by the president and attested by the secretary, and be entered in the permanent book of records kept for such purposes.

SEC. 11. It shall be the duty of the board of directors to make an annual report concerning the operations of the bank, examine the accounts and reports submitted by the manager of the bank, and to approve or disapprove same; to examine into and pass upon all recommendations of the manager for the welfare of the bank, to provide for and regulate the expenditures and expenses of the bank, and to provide for the examination of the accounts, and the auditing of the accounts at least once in every month.

PRESIDENT.

SEC. 12. It shall be the duty of the president to preside at all regular meetings of the board of directors; to sign all minutes of the meetings of the board, and to direct the secretary to call such special meetings as may be necessary, and in the absence of specific action of the board of directors, to give such instructions to the manager of the bank as may be necessary to further the interests of the bank.

MANAGER.

SEC. 13. The manager shall exercise a general supervision and control over all affairs of the bank, under the direction of the board of directors; shall have the control of the personnel, and shall be charged with the keeping of the records and accounts of the bank; shall execute all necessary documents pertaining to the sale or transfer of real estate, release of mortgages, or for any purpose neces-

sary to carry out the acts authorized by the board of directors. He shall control all the real estate and improvements on property which may come into the possession of the bank by foreclosure or otherwise, and shall be charged with the safe-keeping of securities, mortgages, bonds, moneys, and so forth, pertaining to the bank. He shall render such reports to the board of directors at such time and in such manner as they may prescribe. He shall make recommendations to the board of directors relative to the management of the bank as he shall deem necessary, and in the absence of specific directions of the board of directors or the president may take such action to protect and further the interests of the bank as he may deem essential, which action shall be reported at the next meeting of the board of directors, taking place thereafter. He shall instruct the agents and employees of the bank in their respective duties and prescribe such rules and regulations for the proper conduct of the business as appears necessary. He shall forward to the board of directors all complete applications for loans, with his recommendations thereon. He shall prescribe the method of book-keeping and accounting to be used by the bank in all of its branches, subject to the approval of the board of directors.

AGENTS.

Sec. 14. Provincial and municipal treasurers acting as agents for the bank shall be responsible directly to the manager of the bank, and shall render any accounts or statements called for by him, and shall keep such books and records as he shall prescribe.

Sec. 15. Provincial and muncipal treasurers, whenever they have been constituted agents of the Agricultural Bank under the provisions of section six, Act Numbered Eighteen hundred and sixty-five, may be authorized by resolution of the board of directors to receive deposits for the bank either on time or in open account.

SECRETARY.

Sec. 16. It shall be the duty of the secretary to keep the minutes of the meetings of the board of directors and to have the custody of all the records of said board. He shall be the custodian of the seal of the bank, and shall affix the same to all documents signed by the president or manager, which, in the opinion of the president or manager, or by law, require the seal. He shall perform such other duties as may be prescribed by the manager of the bank.

LOANS.

Sec. 17. All loans from the Agricultural Bank shall bear interest at the rate of ten per centum per annum, payable at least once a year, to be computed from the date of payment by the bank to borrower to the date of repayment of the loan to the bank. All loans shall be in multiples of fifty pesos. Loans of ten thousand pesos or more but less than twenty thousand pesos shall require the affirmative vote, or subsequent approval of the resolution, of four members of the board of directors. Loans of more than twenty thousand pesos shall require the affirmative vote, or subsequent approval of the resolution, of all members of the board of directors.

DEPOSITS.

Sec. 18. Time deposits will not be received in amounts of less than fifty pesos.

Sec. 19. Interest on time deposits shall be paid as follows :—

For six months, at the rate of two and one-half per centum per annum.

For one year or longer, at the rate of three and one-half per centum per annum.

Sec. 20. Time deposits shall be evidenced by certificates of deposit, which shall be signed in Manila by the manager of the bank and in the provinces by the agent of the bank.

Certificates of deposit shall be negotiable and the interest thereon shall be payable at the office of the bank were deposited, on the date of the expiration of time shown on the certificate and unless renewed, interest will cease from said date.

Sec. 21. Deposits in open account shall be signed by the agent of the bank in the provinces and returned to the depositor, the other copy to be preserved with the records of the bank. Depositors shall also be furnished pass books.

No original deposit shall be received of less than five pesos.

WITHDRAWAL OF DEPOSITS.

Sec. 22. The bank may permit the withdrawal of fixed deposits at any time on the surrender of the certificate of deposit, properly indorsed: *Provided*, That no interest shall be paid unless the deposit remains the full length of the time for which the certificate is issued.

Sec. 23. Any portion of a deposit in open account may be withdrawn by check, properly signed by the depositor. Blank checks shall be furnished by the bank on request.

MORTGAGE.

Sec. 24. All mortgages guaranteeing loans shall be made in such form as required by the manager of the bank, with the approval of the board of directors. All mortgages shall contain among others the stipulation that funds advanced thereunder shall be used solely for the purpose therein designated, that the mortgagor shall pay the taxes, and any failure or neglect to so use the funds or to otherwise observe the explicit terms of the mortgage agreement, will work a forfeiture of the mortgages and terminate the periods of loans as expressed in the mortgage, resulting in foreclosure proceedings or any other action on behalf of the manager of the bank that may become necessary to protect the interests of the bank. Whenever in the opinion of the manager of the bank such a course is advisable, the mortgage shall contain a provision that the principal of the loan secured by the mortgage may be retained by the bank and paid out from time to time as the expense for which the loan is made falls due, or as the money is required for the purpose for which the loan is made.

Sec. 25. Upon the breach of any mortgage condition which shall become known to any officer or employee of the bank, it shall be the duty of said officer or employee to report to his immediate superior, who shall take immediate action to notify the manager of the bank, who shall take such action as he may deem necessary to protect the interests of the bank.

INSURANCE.

Sec. 26. Prior to the advance of any money on a loan by the manager of the bank, the borrower shall deliver to the proper officer of the bank an insurance policy against fire, covering the buildings, improvements, or stored crops, as the case may be, which are offered as security for the money, in such amounts as are required by the board of directors. If the borrower neglects to pay the premium on insurance on the property mortgaged, the bank may pay such premium and the amount so paid be chargeable to the borrower.

APPRAISEMENT OF PROPERTY.

Sec. 27. Before any loan is granted by the board of directors, the property shall be appraised. The manager of the bank may, before submission of the loan to the board, have the property offered as security appraised by a committee, the members of which shall be appointed by him, and who shall in no way be associated with the applicant for the loan, and shall be acquainted with the property valuations in the locality where the property is situated. Said committee shall certify under oath that they have a knowledge of the property offered as security and that they believe the actual cash value thereof as stated by them is just and reasonable and the condition of the property is such as to warrant a loan of the amount stated in the application, or such amount as they may determine.

PERSONNEL.

Sec. 28. The personnel of the bank shall consist of a secretary who shall not receive more than four thousand pesos per annum.

Manila, September 22, 1908.

Approved as provided by section 8, Act No. 1865 of the Philippine Legislature.

JAMES F. SMITH.
Governor-General.

REGULATIONS.

(Agricultural Bank of the Philippine Government, 1909.)

All officers and employees of the provincial agencies of the Agricultural Bank of the Philippine Government are governed by the provisions of Act No. 1865 creating the bank, Acts, amendatory thereof and by the by-laws adopted by the Board of Directors of the bank.

The following regulations are promulgated for the information and guidance of all officers and employees of agencies of the Agricultural Bank of the Philippine Government and strict compliance therewith is requested.

REPORTS.

1. Immediately upon balancing the books at the close of business on the last business day of each week, a report on Form No. 13 shall be made out and mailed to the Manager at Manila. This report should show; (a) The total of all deposits made during the week, (b) the total of all withdrawals made during the week, (c) the total amount remaining on deposit in the Agency at the time the report is made, (d)) the number of new accounts opened during the week, (e) The number of accounts closed during the week, and (f) The number of active accounts on the books at the time of making the report.

2. Immediately upon balancing the books at the close of business on the last business day of each calendar month, a report on Form No. 13 shall

be made out and mailed, giving the same information for the month as the Weekly Report gives for the week.

LOANS, PAYMENT OF INTEREST AND PRINCIPAL.

3. When it is more convenient for a borrower from the bank to pay the interest on his loan to an agency, instead of to the main office, he will be directed to do so, and the agency is authorized to receive and receipt for the same.

4. Interest paid into an agency should be remitted to the main office of the bank at Manila, at the close of business on the day collected. Forms of receipts and remittance blanks will be furnished all agencies by the bank.

5. Payments on the principal of loans may be paid, collected, and remitted the same as interest.

6. All loans will be made from the main office, but applications therefor may be left at any agency for forwarding to the Manila office.

CHECKS AND CHECK BOOKS.

7. A record of all check books issued shall be kept, showing the dates sold, the name of the depositor to whom sold, and the inclusive numbers of the checks contained therein.

8. All blank checks will be furnished to depositors by the bank and checks or orders drawn on any other form than that supplied by the bank will not be honored.

9. No blank checks shall be furnished by one depositor to another, and the agency will refuse to honor a check signed by any one other than the depositor to whom the blank check of that number was originally issued.

10. Only such quantity of blank checks as the activity of the depositor's account warrants, shall be issued at one time and the quantity so issued should be such as to supply the depositor for approximately thirty days: *Provided*, that not less than one book, or the unused portion of a book returned by some other depositor (after the stubs of used checks are removed), shall be issued.

11. Checks on the bank may be made payable "to bearer" instead of "to order," if the drawer so desires, but in all cases, the bank shall require the indorsement of the original payee and that of the party cashing such checks: (See Regulations 16, 17 and 18.) It is suggested that the use of checks payable "to bearer" be discouraged in every possible way.

12. A depositor's account should always be consulted before a check drawn against it is paid or certified.

CERTIFIED CHECKS.

13. Checks may be certified by agents when such checks are desired for purely provincial purposes, or for use in payment of custom duties, taxes, etc., and when so certified may be used throughout the province in which the agency is located. However, where the practice of certifying checks interferes with the sale of demand drafts or telegraphic transfers, certification will not be permitted. When a check is certified, the amount thereof shall be immediately charged to the drawer's account. (See Regulation No. 22).

SIGNATURE CARDS.

14. The signature of each depositor shall be obtained at the time he makes his initial deposit with the bank, upon the signature cards furnished, which cards shall be permanently retained in the files of the Bank.

PAID CHECKS.

15. Paid checks shall not be returned to the drawers but shall be permanently retained by the Bank.

INDORSEMENT.

16. All indorsements on checks must be dated the day the indorsement is written, and when check books are issued to depositors this requirement should be impressed upon them. (See Regulation No. 11.)

17. Two witnesses shall be required to an indorsement by mark, the address of each witness to be stated on the check. This is the practice followed by the Insular Treasury and all commercial banks. In cases where an indorsement consists of Chinese or Moro characters, one witness may be accepted to such indorsement, provided all parties are known personally by the bank officials; otherwise two witnesses shall be required with the address of each stated.

18. When checks are made payable to the order of a firm, corporation, company, or co-partnership, the indorser for any one of them should be required to submit, and permanently file with the agency, evidence of authority to indorse for and on behalf of the firm, corporation, company or co-partnership concerned. The same rule shall be followed in cases where one individual indorses for and on behalf of another.

BANKING HOURS.

19. Agents should establish and maintain regular banking hours for transacting business with the public.

20. Each day, after the close of business with the public, all the accounts of the bank shall be posted and balanced.

MISCELLANEOUS.

21. The Insular Auditor has no supervision over the accounts of the bank except in so far as may be necessary to obtain information concerning the provincial treasurer's cash accountability as provincial treasurer.

22. Demand drafts and telegraphic transfers will not be sold by the Bank or any of its agencies; but this business will continue to be done by the provincial treasurers as heretofore, under Act No. 1636. (See regulation No. 13).

23. No funds will be received on interest-bearing time-deposit until the agency is authorized to do so by the Manager.

24. All deposits and withdrawals made by a depositor during a day should be entered in one sum on the proper side of the cash book at the close of business each day, and then posted to the depositor's account in the ledger.

25. No information concerning a depositor's transactions with the bank shall be furnished to any person by any officer or employee thereof; and any officer or employee of the bank violating this regulation shall be removed from the service.

MISCELLANEOUS.

THE SAIDAPETH AGRICULTURAL COLLEGE AND FARM.

By C. BENSON, M.R.A.C.,
Late Deputy Director of Agriculture, Madras.

(From the *Agricultural Journal of India,* Vol. IV., Pt. IV., October 1909.)

This Institution has now, after a chequered existence of over forty years, been closed. Its history is connected with the work of the Agricultural Department of Madras and the earlier efforts of Government towards Agricultural improvement. Some account of its early days may, therefore, not be without interest. Its work was then alluded to as typical of what should be done in India in the cause of agricultural advancement, and visitors came from all parts of India to consult its Superintendent, Mr. W. R. Robertson, M.R.A.C. The history of this farm will afford enlightenment on various points connected with the correct establishment of Government farms.

In 1863 the then Governor, Sir William Dennison, drew attention to the practice of cropping without rotation, to deficient manuring, to the extensive use of cattle manure as fuel and to defective implements and cattle. He suggested the importation of improved agricultural implements, and accordingly a steam plough, a variety of smaller ploughs, harrows, cultivators, seed-drills, horse-hoes, threshing machines, winnowers, chaff-cutters, waterlifts, etc., were obtained from England.

About this time the Collector of Madras (Chingleput) started a "Model Farm" of about 350 acres at Saidapeth which had recently become Government property, "partly with a view to demonstrate the value of the new implements to the satisfaction of the ryot and to remove native doubts as to the advantages derivable from them, partly to test various manures, partly to exhibit an improved system of agriculture." These views were endorsed by the then Secretary of State, who expressed a hope for "a continuance of this interest in a question so closely allied to the welfare of the people."

The management of the farm was first entrusted to a Committee of gentlemen interested in the work who placed a Superintendent in charge on Rs. 75 a month. The post of Superintendent changed hands four times in the first two years, and as this was highly unsatisfactory, the Committee decided to get from England on a salary of Rs. 200 a month "a highly educated farmer, acquainted with agricultural chemistry and machinery and possessed of a thorough practical knowledge of all farming operations, and the management of cattle, sheep, etc." But the man obtained turned out "to be an ordinary farmer, without any scientific education, wedded to his own ideas and opinions, and carried on the business of the farm just as he thought proper, with very little regard to the instructions given him." After eleven months' trial, the Managing Committee found him unfit

for the post and had to make temporary arrangements again for carrying on the work.

In November, 1868, the late Mr. W. R. Robertson arrived to take up the post of Superintendent. The Committee soon found that he was "exactly the man they wanted," and from that time forward, the work at Saidapeth was Mr. Robertson's work. In 1871 the Managing Committee ceased to exist, and the general supervision of attempts towards the advancement of agriculture in Madras was entrusted to the Local Board of Revenue, and the actual management to Mr. Robertson. About this time, and largely as a result of the efforts of Mr. Robertson; the Government of Lord Napier resolved on a comprehensive scheme for starting experimental farms in various parts of the Presidency. This scheme is only now, 35 years later, being put into effect, but that Mr. Robertson's work was appreciated is shown by the fact that in 1878, the Government of India, in the course of a general review, recognised that in Madras there was already a Department of Agriculture, and held that its expansion was impeded mainly by want of funds.

As a preparation for the study of Indian agriculture, Mr. Robertson had the advantage of experience among Irish peasant cultivators, but in his first eight years in India he was greatly handicapped by the fact that he had no opportunity of making himself acquainted with agricultural practices and conditions in Madras as a whole, while the site of the farm at Saidapeth had been unfortunately selected in a locality which did not represent any ordinary agricultural conditions in the Presidency. Geologically the soils are derived from alluvial deposits, probably estuarine, and their "general character is that of pure, or nearly pure, silicious sands," though beds of black clay occur below the surface, and in one or two places they crop out on the farm, whilst a ridge of metamorphic rocks runs through the southern portion of the estate and crops out in two or three places. This ridge has a considerable influence on the underground water-supply derived from the Adyar river which bounds the estate on the south and on the east where it is tidal and salt. The soils are deficient in the power of absorbing and retaining moisture, and on wetting they decrease in bulk considerably, and when they again dry, they become very hard, especially at the surface. Their composition is shown in the following analysis:—

Const tuents	Field No. 1* Surface soil. per cent.	Field No. 4* Surfsce soil. per cent.	Sub-soil. per cent.
Alumina	3·24	4·12	2·060
Oxide of iron	1·35	1·80	2·900
Phosphate of lime ..	0·12	0·24	0·009
Carbonate of lime ...	0·31	0·70	0·560
Carbonate of magnesia	Trace	Trace	Trace
Sulphate of lime ..	Trace	Trace	Trace
Chlorides..	0·90	1·08	0·720
Organic matter.. ..	2·12	2·50	1·740
Moisture	2·09	2·76	1·420
Sand	89·87	85·90	90·400

These fields represent some of the best of the land on the estate, and there the outcrop of the estuarine clay considerably influences the character of the soil, and the "sand" found is extremely fine in texture. The greater part of the estate is thus described by Dr. Voelcker: "It has a poor hungry sandy soil, and the land is little better than a great sand-hill" and "ought never to have been selected."

In 1871 the site of the farm was condemned by General Cotton who had taken a prominent part in the selection of the implements originally brought out, and who as early as 1868 had pressed on the Government of Madras the necessity for a special department to be entrusted with agricultural improvement "in all parts of the country," so that Government should "not be dependent upon the scanty leisure or casual half-hearted efforts of untrained persons, whether Collectors or their delegates." The main grounds of his indictment of the farm were that "neither the extent nor the variety of soil render it sufficiently typical for a Central Farm, nor were the irrigation facilities such as to enable the great questions of the value and use of water to be properly asked and answered"; but Mr. Robertson who at that time anticipated the early start of the above-mentioned scheme of district experimental farms defended the retention of Saidapeth mainly, it is believed, for its nearness to the head-quarters of Government, and his defence was accepted.

In the early days of the farm a great deal of attention was devoted to implements and machines. In their very first report the Committee remarked that though their trials had been incomplete, they had proved, on the whole, highly satisfactory and led them "to hope that ryots of this Presidency would soon learn that the extensive use of English implements and machinery in the cultivation of the land was certain

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* These field numbers are those used in the map published in the "Records of the Saidapeth Farm," 1885; they were altered later on.

to be attended with great advantage." In this they were mistaken. With ploughs the early experience was unsatisfactory. A windmill with throw pumps was also tried and failed; for in the still season of the year it was almost useless. A bucket pump (by Burgess and Key) was, however, tried with better result, and figures were published to show that it lifted water at scarcely one-third the cost involved in using the *picotta*. For chaff-cutters a demand soon sprung up, and one of the winnowers imported was said to be much applauded. In 1866-67, a steaming apparatus for preparing cattle food was imported, but its later history is not clear, though a story regarding it is worth recording. One day one of the numerous amateur authorities on agriculture who was visiting the farm, on seeing it, remarked: "Oh! I see! A steam plough!"

Until Mr. Robertson arrived, the trials of implements, etc., were not at all systematic. Neither in those days nor for long after was any real attempt made to test indigenous implements thoroughly. Soon after his arrival the farm had begun to manufacture implements, etc., and a number of implements and tools had been sold in various parts of the Presidency. At the same time, a special grant was made to enable the Superintendent to import implements and machines from abroad to meet local demands. Mr. Robertson then reported that "we have now facilities to experiment with a view to determine the shape and description of implements best suited to the circumstances of the Indian ryot, and last but not least, we can prove to the Indian cultivator that his local smith and carpenter can make up and repair any of our most useful implements." The implement to which special attention was given was the plough, and a form was evolved which had considerable advantages. At the same time, a leaning towards American styles became general, and imports from that country were frequent, especially of chaff-cutters and maize-hullers. Of these machines, as well as of a number of waterlifts, including a bucket-pump driven by a steam engine, trials were recorded in 1870, and it was then that the Double-Mhote, to which Mr. Robertson became greatly devoted, was first mentioned, and the data then recorded as to the cost of lifting water, though slightly modified by him in respect of the Double-Mhote, remained those of reference on the subject until Mr. Chatterton's trials* of 25 years later.

* *Vide* Bulletin No. 32 of the Madras Agricultural Department, dated 1905-06.

Speaking generally, it was to waterlifts and especially ploughs that attention was thereafter directed at Saidapeth, but notwithstanding the many advantages of ploughs of European type, they have not still come into general use. In later years several private firms spent considerable sums in endeavours to push the trade in such ploughs. There is, however, one exception to this, and that is the introduction from Saidapeth in the late seventies, largely owing to the efforts of the late Sabapathy Moodelliar, of the heavy iron ploughs now so generally used in the Bellary and Anantapur Districts for breaking up black cotton soil which is infested with the grass *kundara nattu* (*Ischæmum pilosum*)*.

But it is not necessary to follow the work done at Saidapeth in respect of implements and machinery further, and I may turn to other matters that early received attention. In the first report there is mention of trials of Lucerne, of which the Committee was not hopeful; of guinea grass, of which it is said that it "is very hardy, easily cultivated and propagated, and yields frequent cuttings"—an opinion amply justified by later experience; of Chinese sugarcane, with which not much success was then attained; and of English clover, with which there was such success that the Committee proposed to get more seed and the seed of Italian rye grass also. In the next year, there were trials of several kinds of exotic tobacco, which were said to have grown well, but of which I have not been able to find any further record; of "French honeysuckle" and Maltese Lucerne, which both apparently failed; and of the Carob bean, some trees of which I can remember as still standing and bearing small thin pods ten years later. The year 1867-68 was notable for several "unauthorised" experiments by the Superintendent, amongst which were the sowing of wheat and field peas and also for the commencement of growing maize which later became a regular crop on the farm; whilst in this year a field was laid down in grass with Hariali (*Cynodon dactylon*). During these years the chief native crops grown were sorghum and horse-gram (*Dolichos biflorus*), and with these fair success was attained. In 1869-70 attention, so far as crops are concerned, was directed to these last two crops with special reference to their

* Ploughs for the same work have only recently been adopted in Dharwar. *Vide* Lecture by Mr. H. S. Lawrence, before the Royal Society of Arts, January 1908. Dharwar adjoins Bellary on the west.

use as fodder crops, and special papers were prepared and published by the then Superintendent on these matters, as well as another on the growth of Carolina paddy. Maize continued to demand attention, and the reports show that Italian rye grass, German beet-root and mangel-wurzel were grown—but condemned; it is also worth noting that Mr. Robertson alludes, amongst other crops which he tried for fodder, to the wild indigo (*Tephrosia purpurea*) of which he remarked that the sheep were very fond, and said that he had selected some seed from wild plants, "and hoped that by cultivation after two or three generations, it will become a useful plant."

It was also about this time that attention was first given to the raising of fodder crops, and this was a necessity from the fact that a considerable flock of sheep was maintained on the farm. It had been started at the opening of the farm, on a basis of Coimbatore and Salem ewes which were crossed with a half-bred Coimbatore-Merino ram, whilst at the same date two Southdown rams were purchased in England, only one of which reached Madras alive. In the next year, Mysore sheep were added to the flock, and some Patna rams were obtained and used, but in 1869, Mr. Robertson pointed out that the flock, although His Excellency the Governor allowed free grazing in his park at Guindy, was far too large, and contained only a comparatively small proportion of sheep that were worth keeping. He then began a system of breeding after selection. In the previous year, some attention was given to the fattening of sheep, and in 1869 several experiments in this line were begun; whilst in 1869-70 there were experiments in feeding cattle also. Pigs had been kept from the first, and though the Committee at one time doubted the advisability of continuing to breed them, they afterwards changed their minds and increased the stock with a view to the sale of sucking pigs and young porkers. Rabbits and poultry were also kept, and of the latter for many years there were continual new importations of good stock from Australia and England. Much of this work was altogether beside the question and was only rendered possible by the peculiar situation of Saidapeth close to a large town like Madras; but the experiments in feeding cattle, though primarily intended to test the fattening value of fodders, etc., are of some interest, as they are, I believe, the only tests that have been made in India of the feeding value of local produce.

It should be mentioned also that at a very early date the feasibility and utility of the "box system" of housing cattle was clearly demonstrated there and, as Mr. Robertson remarked in 1870, "there can be no reason why working and young cattle should not be kept in loose boxes at night, and there is no better or more economical way of making manure than under the loose box system. On sanitary grounds alone, the system is worth general adoption." Further experience has only confirmed the justness of these conclusions.

In 1871 a new departure was made by dissolving the Committee. In submitting the last report its President, Mr. (afterwards Sir William) Robinson, whose influence in later developments was very great, fully reviewed the work in a letter worthy of study. From this time onwards the work of the farm was greatly concerned with implements, especially ploughs and with fodder crops.

When the scheme for district farms was formulated by Government in 1871, the primary difficulty was the provision of competent Superintendents, and a class of apprentices was formed to supply these. For training such men the Agricultural College was eventually established on the Saidapeth Farm. Meanwhile the superintendent was provided with two Assistants. Of the latter I was one, and the other was recruited direct from Germany by Sir William Robinson. We were intended to relieve Mr. Robertson at head-quarters, but before this was possible the Agricultural College had commenced work in October, 1876. The scheme of training was far too complicated and elaborate, whilst no proper provision was made for the teaching staff—though Mr. Robertson proposed the appointment to the staff of an Agricultural Chemist, a Botanist and a Veterinary Surgeon, both for scientific investigation and for professorial duties—the idea being that instruction in veterinary science should be given at the College. And though the idea under which the College was started was undoubtedly correct—it is now being given effect to in all Provinces—the fact that provision for experimental enquiry in all parts of the country dropped largely out of sight was, perhaps, the real cause of the failure of the institution.

A few years later, there came the establishment of the Agricultural Departments (or Land Records Departments), and there Mr. Robertson was not provided with a post. The College was handed over to the Educational

Department, and the farm was for a short time retained under the Agricultural Department as a temporary seed and cattle depôt. In 1885 the latter connection was finally broken up, and about half the old farm estate was attached to the College for teaching purposes, and the remainder was distributed for various public purposes.

With the history of Saidapeth for the last 25 years I have had no intimate connection, but I have tried to give here a sketch of what was done in connection with what was one of the earliest, if not absolutely the earliest, persistent efforts made in India towards the development of a sound method or policy in the matter of agricultural improvement and to which effort may easily be traced much of recent development in the direction. I think that it will be admitted that on the whole the Saidapeth Farm did useful work as the pioneer of agricultural work which we all hope will now be more persistent.

CO-OPERATION FOR SMALL HOLDERS.

(From the *Journal of the Board of Agriculture*, Vol. XV., No. 8.)

The following paper on Co-operation was read by Mr. E. J. Cheney, one of the small Holdings Commissioners, at the Conference of Representatives of Local Authorities convened by the President of the Board of Agriculture and Fisheries, and held in London on Wednesday, 7th October, 1908:—

"I am honoured by being asked to introduce the subject of co-operation to your notice this afternoon, and, having regard to the limited time at our disposal and to the impossibility of dealing adequately with a subject of such importance in the course of a few brief remarks, I propose to omit the usual statistics and references to the progress which co-operation has made on the continent of Europe, and to confine my observations to a few salient facts in regard to co-operation as it affects the small holdings movement.

"Before proceeding further, I should like to emphasise the fact, to which the President referred at a meeting at Norwich on Saturday last, that there are two separate and distinct branches of the farming, market gardening and fruit-growing industries:—(1) The productive; (2) the distributive.

"At the present time the grower or producer attempts to deal with both branches of this business himself, and fails entirely to realise that they are very much more separate and distinct than he is disposed to imagine. The first requires an agricultural training, and the second a business or commercial training. I fear the large majority of the farmers of this country do not appreciate in the least what a very distinct line of demarcation there is between the two, and, however well qualified they may be with regard to the productive side, they have a very great deal indeed to learn with regard to the distribucive side. The truth of this must be patent to everyone, if it is considered what a wide commercial knowledge and experience is required before a man is considered competent to conduct a large merchant's or trader's business with any prospect of success, and yet the farmer, with no commercial knowledge at all in the strict sense of the term, considers that he can compete on equal terms with men who are head and shoulders above him in their knowledge and experience of their own particular branch of trade.

"Now, the only way in which farmers can get over this difficulty is by forming themselves into powerful agricultural co-operative societies, and by employing a staff of expert managers to look after the trading side of their business. This has been done with great success in Norfolk and Suffolk, where a large society exists, managed by an elected committee of thirty of the leading agriculturists of the two counties in conjunction with a competent staff of experts. By this means the two branches of the farmers' business are combined.

"Now, if it is necessary for the large farmers to combine in order that their business may be conducted to the best advantage, how much more is it necessary that the small holders should do so, and so be in a position to buy their requirements and market their produce on the best terms possible? The small man will be too busy to attend markets or to study them, all his time will be occupied in tending his crops and his stock, marketing must be left more or less to chance, a few flooded markets may cause his ruin, and unless the small men will form themselves into local societies the development of the small holdings movement will be hampered very seriously indeed.

"To my mind, and I do not speak without experience, the co-operative movement should be developed upon the following lines:—

"Firstly, there should be one large society for a county or group of counties;

"Secondly, there should be small local societies, affiliated to the large one; and

"Thirdly, there should be a central bureau or intelligence department, where the managers and representatives of the large societies could meet to discuss questions of policy and of contracts and to organise an interchange of trade and the marketing of produce.

"An attempt is being made at the present time to promote joint action between the agricultural co-operative organisations of England, Scotland and Ireland, and if the fact is realised and accepted that the central body must not be a trading body but a central bureau or intelligence department, it will be of the greatest assistance possible, and will help considerably the agricultural co-operative movement generally. It could be run, too, without imposing any tax, either openly or otherwise, on the trade of the societies affiliated to it.

"Under a system of the kind the small man would be placed on equal terms for trading purposes with the largest farmer in the country.

"To illustrate what I mean, the large society to which I have referred, admits small societies to membership on the basis of one 5s. share for every ten members; one-quarter of the share capital has been called up, which means that the cost of affiliation to the large society costs the small society 1½d. per member, and for this the small society is admitted to full membership. The large society can supply anything from a tin-tack to a steam engine, and the purchase of coal may be taken as an example of the advantages which a small man would derive from joining it. This society makes contracts direct with the colliery for from 5,000 to 10,000 tons of coal at a time, and if the small society could take one or two trucks, it would obtain them at a price which might mean a saving of from 5s. to 7s. 6d. a ton on the cost at which its members could obtain coal in small lots locally. The small society could also obtain the best seeds, the best cake and feeding stuffs, and the best artificial manure and other requirements at the lowest price possible.

"Then with regard to the marketing of produce and stock. Take the pig trade by way of illustration. The farmers of Suffolk are very large pig breeders, and the usual practice was to send the pigs to the local markets. This method answered very well when the markets were not glutted, but when they were the results were disastrous; another drawback was that the pig markets were in the hands of a ring who controlled the prices to their own advantage. To get over this difficulty the society decided to have their own expert, a man who is in touch with all the important markets throughout the country. Between £60,000 and £70,000 worth of pigs passed through his hands last year. The effect of this arrangement is that the pig ring has been broken, flooded markets are avoided, and members can rely on obtaining the highest market price of the day.

"Now there is no reason whatever why this system should not be multiplied indefinitely, and applied to the disposal of fruit, vegetables and the like. I came across a case only last week where a man sent one ton of apples and garden stuff to London and received in return a postal order for 2s.; that kind of thing is a matter of common occurrence, and unless steps are taken to organise the producers, and to insure as far as is practicable that they shall reap a fair and proper return for their labour of months, I am afraid it will go very badly indeed with them. Then again produce must be sent to the consumer in the best condition possible; almost everything pays for careful grading, and this, as a rule, could best be done by the experts of the large society of the district. I cannot refer further this afternoon to this most important question, but I hope I have said enough to cause you to realise how absolutely vital organisation is to the success of your tenants, and how necessary it is to encourage it in every possible way.

"I will now make a few remarks on the subject of land renting associations, which will be as a rule trading bodies as well.

"When the Small Holdings Act came into operation there was a great rush to form associations, but unfortunately many of them were formed under a misconception of the amount of share capital that would be required. Some of the promoters seemed to imagine that twenty men, for example, had only to form themselves into a registered association, with a capital of say, £50, and to apply to a county council for 200 acres of land, and they were bound to get it.

"The question of capital has received the careful and serious attention of the Board, who have come to the conclusion that councils are justified in letting land to an association, provided its nominal share capital, called and uncalled, is equal to three years' rent of the land applied for, it being thought that this

amount of share capital, which is a separate and distinct matter from the amount of capital required to farm the land properly, will impose a sufficient liability upon the members of the Association to furnish a gurantee that they will not admit unsuitable persons to membership. When associations are prepared to pay six months' rent in advance, or can provide an outside guarantee, of which the council can approve, that the rent will be paid when it becomes due, a lesser amount of share capital may be considered as being sufficient, but to my mind the first is far and away the best system to adopt, and I am pleased to be able to state that two important societies have been started under it already, one at Mere in Wiltshire, which takes possession of 452 acres of land this Michaelmas, and the other at Biggleswade in Bedford, to which land has been let to the extent of 280 acres, also from this Michaelmas. The importance of societies of this kind cannot be overestimated, since their success depends on mutual responsibility, which paves the way to credit banking and other important branches of the co-operative movement.

"The gain to a county council from letting land to an association is also considerable. Only one rent would have to be collected instead of say twenty to thirty, and the committee of the association would select the tenants and be answerable for the proper cultivation of the land. The gain to the members of the association would also be great, mainly because of the help which it would be to them in their farming operations. An association could invest a portion of its capital in some of the heavier farm implements, such as Cambridge rolls, drills, and the like. There is indeed no limit to what can be done by self-help and co-operation.

"There is another most important factor to consider in connection with the movement, namely, the position of the industrial or distribution societies in relation to it. The turnover of these societies runs into millions, the Leeds society alone deals with produce which it would take from 60,000 to 70,000 acres to grow, not counting beef, mutton, milk, poultry and eggs.

"I much regret to find that societies of the kind have not shown any serious indication at present of either applying for land or of a desire to establish their members upon it. In my humble judgment, schemes of the kind would be bound to succeed owing to the ready market which the industrial societies have at their command, and even supposing that the astute business men at the head of the industrial co-operative movement cannot see their way to recommend their members to embark in the cultivation of land, I would impress upon them the desirability of forging a bond of union between the agricultural and industrial branches of the movement, whereby the organised producer of the country is brought into direct touch with the organised consumer of the town.

"There is only one other matter in connection with co-operation to which I will refer: it is the very important one of mutual live stock insurance. In view of the conditions under which the small holders will farm, it is essential to his success that he should run as few risks as possible, and to that end he must be placed in a position to insure his crops and his stock. He would find no difficulty in covering them against fire or against hail, but he would find considerable difficulty at the present time in protecting himself against other risks at anything like a reasonable rate. The death of a horse, a cow, a fat pig and the like would be a very serious matter indeed to the small man, and might mean the loss of a considerable portion of his income for the year.

"A co-operative insurance society is about to be started in London. I would urge upon the promoters the extreme desirability of putting the insurance of stock before that of fire, and of placing means at the disposal of the small men by which they could extricate themselves from the serious financial difficulty in which the loss of stock would involve them.

"Before sitting down I wish to make a brief reference to another important subject, namely, that of agricultural education. If the small holdings movement is to succeed in the way it can and ought to do, education and co-operation must go hand in hand, and the movement opens up a splendid field of usefulness to your technical instruction committees.

"I venture to think that the necessity for providing scientific and practical instruction in agriculture has never been more pressing and I suggest that special efforts should be made to apply the results of scientific research in a practical and business-like way.

"No one realises more than I do the value of scientific knowledge, but what I feel strongly is that the time has come when the results of research should be applied in a practical way, when the

knowledge obtained at Rothamsted, at Woburn, and other stations of the kind, should be brought directly to the door of the small man.

"Experimental plots are necessary, no doubt, for students at the universities, agricultural colleges, and agricultural institutes, but to the small man they are almost valueless:

"I should like to see county councils taking an allotment or small holding in every district under their own direction and control by arrangement with the tenant, and applying to the cultivation of that holding the most approved methods of scientific cultivation; seeing is believing, and if the small men of a district saw an allotment in their midst yielding better monetary results when treated and cultivated in the light of scientific knowledge, the value to them would be almost incalculable, and would be the means, not only of putting money into their pockets, but of raising the standard of intelligence throughout the country side and of adding to the interest and charm of the cultivation of land—than which no more interesting occupation is possible."

LITERATURE OF ECONOMIC BOTANY AND AGRICULTURE.

BY J. C. WILLIS.

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THE INTRODUCTION OF IMPROVEMENTS INTO INDIAN AGRICULTURE:

BY THE WORK OF AGRICULTURAL DEPARTMENTS.

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I.—INTRODUCTION.

The essential difference between Agricultural Departments in the East and in the West is that the latter have arisen to meet the spontaneous demands of the cultivators of the soil, whereas

the former have been lately created by a bureaucratic Government anxious to give all the assistance it can to its agricultural subjects. The demand for improved agriculture has not in India, except in special cases, come from the cultivator. While, therefore, in the West the cultivator is naturally in direct touch with the Department of Agriculture, in India it is necessary for the Department to put forth every effort, first to ascertain the needs of the cultivators and then to demonstrate how they can most effectually be met.

The subject of the present report is a consideration of the methods by which these ends have been attained and of the improvements which have been introduced as a result. It must not be forgotten, however, that the success of a particular method in one area by no means ensures its success in another, since the conditions vary so enormously in different parts of India. This has necessitated the description of the conditions, under which a method has been found effective, in far greater detail than would have been otherwise necessary and the giving of a number of illustrative examples.

II.—AGRICULTURAL ASSOCIATIONS.

The formation of local associations or societies, which have as their object the improvement of the agriculture in the district, has been one of the most common methods employed for increasing interest in the subject and bringing the Agricultural Departments into immediate touch with the people.

CENTRAL PROVINCES.—In the Central Provinces the agricultural associations which have been founded in every district are very closely connected with the Agricultural Department and in nearly every case the impulse towards their formation has sprung from the Director of Agriculture. The district has been taken as the unit and the Deputy Commissioner is always President of the association. In fact the influence and co-operation of the district officers is considered to be an essential condition of success. It is held that the associations should always remain in close touch with the superior officers of the Agricultural Department and one of these always attends the meetings of the local association. These meetings are held half yearly, generally before the opening of the kharif and rabi seasons. The Director and the Deputy Directors of Agriculture devote some months each year at these times to attending the meetings of the associations. Thus they know the members personally and they consider this personal knowledge essentially necessary. The membership is limited and consists chiefly of substantial agriculturists, owners of villages who are also cultivators, heads of cultivating castes and the like. At the meetings, all the proceedings are in the vernacular and usually consist in a discussion of the results of demonstrations carried out by the members in the previous season and the presentation of a programme of work to be carried out in that which follows. The latter is generally done by the Deputy Director, and his programme is then criticised by the members, modified where necessary and the various pieces of demonstration are allotted to the several members. No work is recommended which has not been already proved by the Department to be likely to succeed. For the demonstration of an improvement the members are assisted with seed, implements, or other material required and their work is regularly inspected by the Superintendent of the nearest farm or other member of the departmental staff. Through the associations the Deputy Director of Agriculture is thus enabled to get into close contact with the people and as a result large numbers of people are attracted to the farms of the Department for information.

The following are improvements that have been introduced as a result of the work done by these associations. The pickling of jowar seed against smut, formerly unknown, is now largely practised; the cultivators in the Chhattisgarh District are beginning to adopt the system of transplanting rice, where broadcasting was previously universal, with considerably increased profits; superior varieties of jowar and of sugarcane have been extensively introduced; new or improved implements suited to the conditions of special tracts have been adopted. But it is felt that perhaps the utility of associations has been best shown in their being the means of bringing the Agricultural Department into contact with the best cultivators, and so winning their confidence.

MADRAS.—There is a Central Agricultural Committee which meets quarterly in Madras, the Director of Agriculture being at present Chairman. It issues leaflets, etc., on subjects of agricultural interest and is also supposed to connect the work of all the district associations. Each district has nominally an agricultural association and some have branch associations in the taluks. Each district association frames its own rules, arranges its own programme of work and

contributes an annual sum to the Central Agricultural Committee for help received. The Collector of the district is ex-officio Chairman of the district association and as a rule the Sub-Divisional Officer is ex-officio head of the taluk association but otherwise no official support is given. Meetings as a rule are nominally held once a month and usually after the district board meeting. Such meetings mainly consist of district board members. Occasionally the Collector of the district inspires a temporary enthusiasm into the work of the association, but the membership is too large and indiscriminate to render it possible for the Agricultural Department to give any real help. It would be invidious to point to any one association and to say that it is doing good work as it is too soon to say how much of this is of a spasmodic nature.

BOMBAY.—In Bombay the development of agricultural associations is taking place very fast. But here the associations, though officially patronised and generally having one of the district officers as President, are much more independent bodies than those already described. They often combine in their functions, other purposes as well as those of agricultural improvement. They are in close touch with the Agricultural Department and in one of the most successful, a superintendent of the local experimental farm has been the secretary of the association. They, however, usually depend largely for their success on the personal influence of enthusiastic local men. Some of them represent a district, others smaller areas, and the latter promise to have considerable success. As a rule the members of the associations are anxious to carry out demonstrations and the difficulty has been to find matters of proved value for them to introduce. Nearly all these associations hold annual agricultural shows some of which have been effective in introducing new implements and methods.

Among the results which have been partly due to the activity of the Dharwar Association, are the rapid popularisation of Broach cotton in the Southern Maratha Country and the more careful selection of Dharwar American cotton seed in the same districts. Other associations have devoted themselves to the introduction of improved varieties of crops and of new implements; to the spreading of superior bulls and in one case to the establishment of a grain bank. It is felt, however, that their utility depends largely on continual touch with the more experienced officers of the Agricultural Department.

BENGAL.—In Bengal there is a provincial association in Calcutta, six divisional associations and a district association in almost every district. These are all purely official bodies dependent for their existence on the amount of interest shown by the Commissioner or the Collector and the officers of the Agricultural Department. The members are land-holders and pleaders and the proceedings are conducted in English. The members have as a rule home farms of their own on which to conduct demonstrations. The cultivators' holdings in Bengal are generally very small, but it is hoped to reach the actual cultivator of the soil through the landlord by means of these associations. They have already done much in the way of seed distribution to cultivators and there is an annual agricultural show in connection with most of the associations. One of the superior officers of the Agricultural Department attends all meetings of the divisional associations and as many of the district associations as possible.

PUNJAB.—In the Punjab there are at present two agricultural associations, at Lyallpur and Hissar. The Lyallpur Association is entirely composed of colonists who are directly interested in agriculture, the number of members being, however, small. This association has been instrumental in introducing improved wheat and also American cotton and has assisted in the introduction of implements such as reapers, horse-hoes and winnowers. The members have been of special value in bringing the needs of cultivators to the notice of the Agricultural Department. The Hissar Association was started mainly with a view to the preservation and improvement of the famous Hissar breed of cattle by providing good bulls and removing bad ones. They are now undertaking similar work in connection with camel breeding. In the Punjab, however, it is felt that the formation of agricultural associations should not be pushed until the work and staff of the Agricultural Department have developed sufficiently to enable it to furnish advice and guidance.

EASTERN BENGAL AND ASSAM.—There has been little development along these lines in Eastern Bengal and Assam. The Agricultural Department keeps in touch with individuals in the different districts who are termed associates and these undertake special pieces of demonstration. In such cases the Agricultural Department supplies seed, appliances, etc., free of cost. In this way the spraying of potatoes has been introduced into portions of Khasi Hills and

saltpetre and bones as a manure for paddy have been brought to the notice of cultivators in the plains of Eastern Bengal.

UNITED PROVINCES.—In the United Provinces the recent policy has been to avoid the creation of agricultural associations by official action but to assist in every possible way associations spontaneously formed. A recently founded association in Mainpuri has already done good work in its first year in the popularisation of improved implements and several of its members (zamindars) are opening small demonstration farms of their own.

CONCLUSIONS.—Taking a general view of the whole question the utility of agricultural associations may be said to depend largely on the presence of a body of men directly interested in cultivation, on the personal touch of the higher staff of the Agricultural Department with the members, on the definite engagement by the members to do definite pieces of work, and on the regularity of meetings, inspections and reports.

In other matters conditions will vary with the district. It may be advisable to have smaller associations than those of a District in some instances. If such small associations can be sufficiently substantial and intelligent, they should be encouraged.

While it is not desirable to discourage altogether associations of which the members are non-cultivating landlords as in Bengal, the primary object should be to interest the actual cultivator himself in agricultural improvement. Such associations can be but stepping stones to this end. No association, large or small, should be formed until (a) a spontaneous demand on the part of the people themselves arises, (b) the Agricultural Department is in a position to advise and guide them in their work. The number of associations should not be greater than the available staff of the department can conveniently keep in touch with.

III.—LOCAL DEMONSTRATIONS.

It must be recognised that local demonstration of any improvement it is desired to introduce, is one of the most, if not the most, effective method of securing its adoption. Considerable success has, indeed, been achieved along these lines. In the case of this method, however, very special adaptation to local conditions is necessary and it is impossible to lay down any scheme which will be of general application. Demonstration farms have in some cases had considerable success in Bombay and in the Central Provinces, but as such they have not been used to any large extent elsewhere.

CENTRAL PROVINCES.—Considerable development has been reached in the Central Provinces where the methods employed are as under :—In the first place, experiment is rigidly separated from demonstration. Nothing is tried in a demonstration farm, which, in the opinion of the officers of the Agricultural Department, is not actually of proved value for the tract in question, and each demonstration farm has a definite purpose in view. A varying amount of land is taken, which should not be greater than the particular purpose demands and the assistant in charge can efficiently manage: a small area carefully cultivated is much better than a large area inefficiently managed. The occupation of the land is purely temporary. It is lent to the Agricultural Department by an annual arrangement and the cultivator to whom the land belongs is guaranteed against loss. He is given also a large share or even the whole of the profits. The land is selected by one of the senior officers of the department. No difficulty has hitherto been found in inducing cultivators to lend suitable pieces of land. An assistant is then placed in charge, specially trained in the particular problem to be demonstrated. Local methods are entirely adopted in working the land, except as regards the particular point to be illustrated. The demonstration plot is visited at frequent intervals by the superintendent of the experimental farm for that particular tract, who has special interest in the success of the demonstrations and, in addition to this, the assistant in charge sends in a weekly diary of work done. He visits the leading men of the villages of his circle and discusses matters with them pointing out the advantages of the improved method and asking them to adopt it in their own villages. It is generally possible to get a fair number of cultivators to adopt the method recommended in the same season as it is being demonstrated to them so that the greater part of the assistant's time is spent in touring from village to village to guide and advise such cultivators. The assistant can supervise the work in about eight villages within a radius of four miles if supplied with a pony. To take a concrete case, in Chhattisgarh where the transplanting of rice is being introduced and where the roads are almost impassable during the rains, it is absolutely neces-

sary that each assistant engaged should ride from village to village of his circle so as to see the work at least every second day. When there is some difficulty in getting the practical part of the new method taught to villagers as in the present case, an experienced transplanter is sent to each village of the circle. He works daily along with the coolies and trains them in various processes. It was thus found possible in 1908 to get as much as 100 acres transplanted in one village and 300 acres in one circle.

The agricultural assistant is ordinarily kept in the same circle for at least a year and, if possible, he is employed to demonstrate some other improvement during the second cropping season. Great care is taken to cultivate friendly relations with the cultivators. From the experience gained it is felt that to carry on demonstration work on a large scale it will be necessary to appoint two classes of men. The one class should consist of educated men who have a thorough practical knowledge of agriculture and who have preferably passed through an agricultural college. The other class should consist of intelligent villagers who can preferably read and write and who have been taken from the land and trained in the improved methods practised at the experimental stations. For every one of the first class, from six to ten of such men could be most usefully employed. They would be attached to a village and each would have to work with his own hands in training the ryots in the new methods recommended.

In addition to the demonstration of the method of transplanting rice in Chhattisgarh, in the same district successful demonstration has been given of methods of using irrigation water most effectively and of how to grow additional crops after early and medium rice. The method of eradicating kans grass by means of Ransome's Turnwrest plough has also been most successfully demonstrated.

BOMBAY.—In Bombay, a dairy farm was started at Poona some 17 years ago. Apprentices were taught improved dairy methods and bulletins giving detailed information were then issued. The result has been so far favourable that separators are now commonly used in all parts of the Bombay Presidency and there is a large trade in butter for consumption in India and for export. The demonstration of the value of some oil cakes as manures for sugarcane and other valuable crops has been so successful that oil-cake, chiefly safflower cake, is now commonly used as a manure in many tracts. Broach cotton was successfully grown on the Dharwar Farm and this success was then demonstrated to cultivators in the district who are now growing it on a large scale.

Apart from special farms a good deal in the way of local demonstration of improvements has been done in a number of provinces. Efforts in this direction have, however, in the past been limited by the smallness of the trained staff available. One most successful piece of such work has been done in Bombay in improving the manufacture of gur (crude sugar) from sugarcane by sending trained sugar boilers to various centres where they produced a higher quality of gur at a considerably less cost particularly for fuel,

MADRAS.—In Madras the general introduction of the iron sugarcane mill was due to the demonstrations of its use being held in important sugarcane tracts. But demonstration farms (areas taken up for demonstration) have not yet been attempted. Considerable success has been obtained in advising people to try better proved methods of cultivation. The planting of single paddy seedlings has, for instance, become a common practice in many of the chief paddy growing tracts. People tried this for themselves on a small scale and they gradually adopted the practice.

The successes of such experiments have at times found their way into the press and have thereby become widely spread. Recently the Agricultural Department has been assisting cultivators to adopt improved practices by lending implements and trained coolies and by the advice, encouragement and assistance of its subordinate officers. The practice of drill cultivation of cotton in the Tinnevelly district has within the last two years greatly extended and though only 750 acres were grown this year by ryots under this system, there is every indication of a rapid extension in future. So far in Madras it has been found best to leave the ryot in full control of the demonstration areas, but in backward areas where it is not possible to get the ryot to carry out the demonstration, it may be necessary to take up land or come to some other arrangements with the ryots and keep it more under the control of the department.

PUNJAB.—In the Punjab owing to the dearness and scarcity of labour particular attention has been directed towards the demonstration of labour-saving appliances. Encouraging progress has been made thus with reapers,

winnowers; horse-hoes and ploughs and hopes are entertained of the extension of the use of hand-hoes and seed drills. The first step has been to show the machine working on a farm or at fairs. In the case of the reaper the demonstration took the form of offering to reap the crops of private cultivators at a fixed price and this has led to the purchase of a large number of reapers by private persons. The cultivators being entirely new to machinery, every assistance has been given by forming classes for teaching village mechanics and farm labourers the management and adjustment of machines, by visiting purchasers frequently and removing difficulties in the field, by providing mechanics competent to execute repairs, by showing purchasers how to organise their labour to the best advantage, by issuing, where necessary, pamphlets of instructions and by sending out men to see that machines are properly stored during the off-season.

UNITED PROVINCES.—Demonstration farms have not been markedly successful in the United Provinces, but some good results have been obtained on private farms conducted on similar lines. For instance, the Meerut Farm has been the means of popularising oats, and the Jatau Farm near Agra (now replaced by one at Phariha) has introduced Muzaffarnagar wheat. The Jalaun Farm in Bundelkhand, whilst primarily an experimental farm, has successfully started the introduction of groundnuts. Incidentally the experimental farm at Partabgarh has served for demonstration in the improved methods of cultivating sugarcane. On the whole, however, small plots in the hands of cultivators have been more effective than actual farms under the control of the department. By this means Muzaffarnagar white wheat has been introduced into a large number of districts as a preliminary to the extension of seed depôts.

EASTERN BENGAL AND ASSAM.—In Eastern Bengal and Assam demonstrations in the spraying of potatoes as a preventive of disease and in the use of bone-meal and saltpetre as manures for paddy have been carried out on cultivators' holdings. The method which is being followed is for the farm superintendent to go out and select the land, then one or more demonstrators who are the sons of cultivators trained at an experimental station are sent out to conduct the demonstration. It is found that cultivators, especially in the Khasi Hills, welcome these demonstrations and are eager for more.

It is obvious that full details of the results obtained by demonstrations of whatever kind are not given in the preceding paragraphs. The information given is only a sketch of some of the successes obtained. It appears probable that the establishment of demonstration plots or farms on lines similar to those adopted in the Central Provinces is likely to prove very useful in many other places. The sympathy and interest of the cultivators should, however, first have been won; without this the method is not likely to have any very marked success.

IV.—VILLAGE AGENCIES.

It has always been a problem of considerable difficulty in connection with the introduction of new implements, to get such as are of undoubted value, adopted by the cultivators, but the institution of village agencies as devised in the United Provinces promises success. These are managed by local agents with whom implements are placed and from whom they can be hired out or sold. Before the agency is established the particular implement is always demonstrated carefully to cultivators on the spot. A member of the staff of the Agricultural Department then visits such agencies from time to time, accompanied by a mistri who can repair the implements. He also visits the cultivators who have adopted them, ascertains whether they are working satisfactorily and arranges for such repairs as are necessary. Arrangements are now being made to train village mistries at Cawnpore in the work of repairing the simpler implements. For such useful implements as chaff-cutters, etc., a stock of spare parts on the spot has been found essential. A register is kept of all those who buy the implements, and an occasional note is sent out enquiring whether cultivators are satisfied. Various implements have been distributed by this means. Village agencies have not yet, however, been tried long enough to enable a definite opinion to be formed of their utility, but they seem to fill a distinct want.

V.—VERNACULAR AGRICULTURAL JOURNALS.

Vernacular Agricultural Journals have been established in several parts of India by the Agricultural Departments.

UNITED PROVINCES.—In the United Provinces a monthly vernacular paper of six to ten pages edited by the Assistant Director of the Department is published at Cawnpore. It has been successful in arousing general interest in

the work of the department and in leading to correspondence. Its value could be enhanced by more careful editing.

CENTRAL PROVINCES.—In the Central Provinces there is a monthly departmental vernacular paper. It has been found that everything which is written must be thoroughly practical, must be very carefully edited, and deal with the immediate needs and interests of the cultivators. The translation into the vernacular must be carefully made by a man who is himself connected with the land. The paper as published, usually contains popular statements of the work of the experimental stations with practical directions to enable the cultivators to apply them to their own circumstances. It contains a "Query and Answer" column in which the readers are encouraged to ask the department for advice. It also furnishes a means of advertising improved strains of seed, agricultural machinery, and other things for sale at the agricultural stations. It consists of 15 to 20 octavo pages and is published in three languages. Its popularity is indicated by the fact that its circulation has recently risen from 2,500 to 6,000. It costs Re. 1 per annum.

MADRAS AND BOMBAY.—In Madras and Bombay no vernacular agricultural journal is issued by the department, this being left to private enterprise. The danger of this arrangement is that as the department has no control of the matter issued, unsuitable or even incorrect information may be published, and it is hence very important that such papers as are patronised should be in the hands of responsible men.

In Madras an agricultural calendar for which there is a large demand has been published by the department. The calendar contains articles and notes on agricultural subjects written by the members of the agricultural and other departments. It is printed in Tamil, Telugu and English. One of the agricultural associations publishes a small vernacular paper on its own. The Committee consider that such journals as are published by the Agricultural Departments should be specially designed to meet the requirements of actual cultivators and land-holders. They should be essentially vernacular publications, with possibly an English edition. To meet the more highly educated English-speaking strata, the Agricultural Journal of India published from Pusa should be the only recognised medium.

VI.—LEAFLETS AND CIRCULARS.

In many countries one of the best means of bringing practical agricultural information to the cultivators of the land has been the issue of leaflets and circulars couched in popular language. In India where the standard of education is lower than in most Western countries the value of such publications is more problematical but they have frequently been used with success.

BENGAL.—In Bengal a regular series of such leaflets is issued both in English and in the vernaculars, and are distributed by agricultural associations. It is, however, too soon to draw any conclusions as to their effect.

MADRAS.—In Madras agricultural leaflets have been published in the vernacular in the district gazettes, and more recently in separate form. The introduction of Banku paddy into a large area is partly due to information thus published.

CENTRAL PROVINCES.—In the Central Provinces the issue of leaflets has been restricted, and such information is usually published in the Journal of the Department. This is considered a better medium on account of its present large distribution. But printed directions are separately issued in the vernaculars, when new seed, new manures, etc., are distributed.

BOMBAY.—A similar plan was also adopted in Bombay in connection with the distribution, some years ago, of foreign varieties of ground-nut. The result has been exceedingly good and especially in the Satara district these superior introduced kinds have now largely replaced the local varieties.

During the past year or two the number of leaflets issued in Bombay has been very much increased. They are published in English and the vernacular of the district to which they apply. They consist essentially of practical directions regarding agricultural improvements and usually one leaflet deals with only one recommendation. They are generally used (1) in connection with demonstrations of implements and methods, as, for instance, at agricultural shows; (2) in a particular area where special need has arisen. They are not usually distributed except in connection with the visit of an officer who can explain the nature of the improvement. Their actual value is still an open question, but they certainly promise considerable utility.

UNITED PROVINCES.—In the United Provinces no generally successful direct results have been obtained by the issue

of leaflets, but the issue of a leaflet giving a list of all the implements kept in stock by the department with working drawings, has led to a large demand for some of these implements, and another leaflet describing the method of cultivation of American cotton has certainly been of use in districts suited to this variety. These leaflets like others now in the press have, however, been published in response to frequent letters of enquiry.

Punjab.—Leaflets were used in the Punjab with great success in the campaign against the cotton boll-worm in 1906. The area affected represented quite two-thirds of the cotton area of the province (or 700,000 acres) and concerted action had to be arranged for in a short time among a large population.

Leaflets enjoining the ploughing up of old cotton fields, the destruction of old cotton stalks and the use of trap crops, as well as explaining the object of these measures, were issued to the number of about 75,000 in each case, to the subordinate revenue staff, for distribution to all who could read. Illiterates were reached through the subordinate revenue staff, each man being directed to make the purport of the directions known to all in his circle. Rewards were offered to those who did specially good work. Leaflets containing directions for the cultivation of American cotton have also been of value.

Burma.—In Burma where the standard of vernacular education among the cultivating classes is high, there has been a large demand for the simple leaflets issued by the Department of Agriculture. Enquiries have shown that they are widely read and acted upon, and revenue surveyors and other revenue officers are encouraged to explain and discuss the subjects with the cultivators,

In general the experience of the past four years tends to confirm the opinion expressed at the meetings of the Board of Agriculture in 1905, that "leaflets to be successful in reaching their object should be brief, perhaps not exceeding a couple of pages and should contain one definite fact or the description of a single process which it is desirable that the ryots should know and adopt, with illustrations where necessary." The vernacular translations of these leaflets to be of real value to the cultivators should only be entrusted to the most practical of Indian assistants. The translations should be essentially free and couched in such language as will make the matter absolutely clear to a cultivator of even less than ordinary intelligence.

VII.—Utilization of the General Vernacular Press.

There has been little systematic contribution to the general vernacular press by the agricultural departments with a view to the introduction of agricultural improvements. In Madras, however, monthly notes from the agricultural departments are sent to papers where their publication is likely to be useful, and in addition, several special matters (such as the advantages of transplanting single paddy seedlings) have been from time to time brought to notice in this way. Similar means are adopted in the Punjab where a press communique is issued once a month to the leading English and vernacular papers and has been distinctly successful where it is confined to information on established success. The press rendered great assistance in the campaign against cotton boll-worm in 1906, in drawing attention to what was being done and awakening general interest.

In almost every province all the publications of the department, including the local journal and leaflets, are sent to the press and such matter is freely taken and published.

There seems little doubt, on the whole, that widely circulating local papers should be recognised as a medium of reaching the cultivators, more particularly where there is no local agricultural paper. No effort should be spared to give contributions a popular readable form such as is likely to command attention.

VIII.—Agricultural Shows and Exhibitions.

Agricultural shows and exhibitions, provincial or local, have been held in every province in India.

Large provincial shows have been held in Bombay in 1904, in Calcutta in 1906 and in Nagpur in 1908 in connection with large industrial exhibitions.

Central Provinces.—Of these the biggest and best was that held at Nagpur in 1908. Its aim was almost purely educative. A carefully selected set of exhibits of all the different agricultural products of the Central Provinces and Berar and elsewhere was arranged, including improved appliances likely to be useful here, from Europe and America. All exhibits were labelled and full information in English and Vernacular was given in each case on the label. The agricultural exhibition was divided up into sections with special assistants in charge of each, who explained everything to visitors in their own language,

All agricultural machines and implements were shown at work daily. Arrangements were made by which cultivators from different districts were brought to the exhibition on definite dates. On these dates special attention was given to such demonstration as would be of interest to the cultivators concerned. For example, the people of Chhattisgarh who are now for the first time learning how to transplant their rice were shown by skilled workers on specially reserved plots in the exhibition grounds the whole process of preparing the land and actually transplanting the paddy.

BOMBAY.—The lines on which the agricultural section of the exhibition of 1904 was run were not very different from those just described. It owed its success to similar causes, though it was hardly so highly developed as that at Nagpur. Nearly 500 selected cultivators were taken to the show, exhibits were demonstrated in four languages and as a result there has been a largely increased sale of improved implements, while enquiries addressed to the department have been steadily increasing.

But such large provincial exhibitions can only be organised on special occasions and under special circumstances. Smaller shows can, however, be held at more frequent intervals and are so held in every province. They range in size from institutions like that at Lyallpur in the Punjab, annually attended by 100,000 people and attached to a large cattle fair, to small taluka shows in parts of the Bombay Presidency or to the demonstrations which are made in connection with the smaller cattle fairs and religious festivals in Madras. It is probable that the principles which should guide the organization of such shows are the following. While local effort may and should direct and arrange the show, the part which the Agricultural Department takes in it should be very carefully organised and attended to by one of the superior staff of the department. Agricultural products which cannot be grown on the cultivators' own land should be excluded. As many things as possible should be shown in motion, as these are always centres of attraction. Popular lectures with lantern illustrations, where suitable, should be combined with practical demonstrations. Farm produce should be arranged in sufficiently large quantities to allow of being handled by those interested. A larger number of small shows thus organised are probably more useful than fewer ones on a large scale, provided local interest is thoroughly aroused. Success in such small shows is, however, largely connected with the presence of working exhibits, which can be sent from show to show. The interest of the cultivators themselves must also be aroused and maintained, and in this connection attention may be called to the magic lantern exhibitions on agricultural subjects arranged in recent years in connection with the shows in Bengal.

It must be remembered, however, that such shows and exhibitions take up a considerable amount of the time of the staff of the Agricultural Department, and this method of introducing improvements should take its place in such order as is considered best for each province.

IX.—ITINERANT ASSISTANTS.

BOMBAY.—In Bombay some of the senior assistants of the department have been employed for a number of years in travelling in the districts, and this method of introducing improvements, getting in touch with the cultivators and finding out the local difficulties, has been so successful that a considerable extension of the system is being made. Among other work these assistants have been spreading large quantities of Broach cotton seed in suitable areas and also superior varieties of ground nut, and reports on the success of these introductions have been collected by the same agency. Experience has shown that only men specially chosen as being able to win the confidence of cultivators should be sent. Further, they are always sent out to tour for definite purposes and are required to furnish frequent reports as to the progress they are making. Definiteness of work and regular supervision are felt to be absolutely essential.

MADRAS.—In Madras there are no itinerant assistants attached to districts. The managers and other officers attached to agricultural stations are encouraged to tour in the tracts to make them thoroughly familiar with the local practice. If any special line of demonstration is to be brought before the cultivator, one of them is put on to special duty. Local fairs and festivals are attended and demonstrations are frequently held there. It is noticed that where such touring has been done the cultivator has begun to realise that the department is working for his benefit. In addition to this a specially chosen senior assistant will now be attached to each Deputy Director. These assistants are further often used by the Deputy Director to go through a district previous to his own tours which are hence

made very much more effective. Useful results have also been obtained here as well as in the United Provinces, by sending members of the staff to interview correspondents whose letters do not make their requirements clear. It is felt that at present itinerating work by the subordinate staff should ordinarily be confined to the tracts represented by the agricultural stations, that they should be attached to an agricultural station in order that they can benefit by the work being done there, and that their efforts to introduce or suggest improvements should be confined to such work as has been demonstrated successfully on that agricultural station.

United Provinces.—In the United Provinces no special men have been kept for this purpose. Most of the farm staff, however, spend a portion of their time on tour, during which they are in daily contact with influential cultivators, who thus become familiarised with the Agricultural Department and the extent to which it can be of assistance to them. Much of the success achieved by the department in the introduction of improved implements and of improved varieties of crops such as Jaunpore maize, Muzaffarnagar wheat and American cotton is directly attributable to such assistants. Whenever letters of enquiry on important subjects are received the reply is, if possible, followed up by a visit from one of the senior assistants.

Bengal.—In Bengal there are two provincial and six divisional inspectors. The former are primarily intended for special work such as collecting seed throughout the province, attending shows to give demonstrations, and reporting on the progress of any improvement which has been introduced. The collection of types of jute seed and of sugarcane varieties has been made by their means. The Divisional Inspectors are chiefly employed in supervising demonstrations, conducted by members of the agricultural associations, but as time permits they assist in other work in their own division.

Punjab.—Little can be added here as regards the Punjab which has not been already noted under previous headings. Assistants have toured to help in demonstration, to advise men who were cultivating American cotton, to assist those who were using implements of a new type, to collect special information and to make special inquiries.

On the whole the employment of itinerant assistants (these being either farm superintendents or special officers employed for the purpose) is a very effective method of reaching the cultivator. It seems essential, however, that these should be men of considerable experience, that they should be employed on one definite piece of work at one time, and that they should be in constant touch with the Deputy Director under whom they are working. If these conditions are satisfied, such men may be of great value for the introduction of new seed, new implements, or new processes which can be demonstrated on tour. It seems very inadvisable, however, to appoint or keep travelling assistants without specific duties.

X.—Seed Farms.

Inasmuch as the provision of pure and improved seed is one of the principal needs of the Indian cultivator and as there are no recognised seedsmen in the country, the Agricultural Department in every province has felt it its duty to arrange for the provision of such seed, and this has proved to be one of the best means of getting into touch with Indian cultivators. Many methods have been used to obtain such seed for distribution, the method followed varying with the conditions of the province and of the class of seed it was desired to supply.

Bengal.—In Bengal the supply of good jute seed has been secured by the establishment of separate farms. This method has, however, not been altogether a success and the need will be met in the future by the devotion to this purpose of portions of the large experimental farms belonging to the department. The selected seed which the department supplies is in strong demand among jute growers.

Central Provinces.—In the Central Provinces seed farms for the supply of selected cotton seed have been established in connection with the agricultural stations belonging to the department. On these however only the initial stages in the production of seed are carried on. When a sufficient amount has been so produced, the seed is given to cultivators to grow for the department under contract.

Madras.—A very similar principle has been followed in Madras in the case of cotton, the seed after careful selection on the agricultural station being given to cultivators to grow for the department.

Punjab.—In the Punjab a large area has been taken up by the department itself for seed growing. There is a 500 acre farm at Sargodah for growing seed of good varieties of cotton and wheat for the cultivators on the irrigation

colonies. Similarly a large area is available for seed growing at the Lyallpur farm and a fair quantity of seed has been already distributed. There is a steady expansion in the demand for such seed.

UNITED PROVINCES.—In the United Provinces no special seed farms are at present considered to be necessery. Two or three privately owned farms make a speciality of seed production, and these have been largely used, more especially for obtaining large quantities of Muzaffarnagar wheat. Beyond this, considerable quantities of selected seed have been distributed from the experimental farms, and great attention has been given to the organisation of the seed supply, especially in the case of wheat and American cotton. The experience so far obtained indicates that there is a considerable demand for good seed. It is essential that this should be met for the present from seed grown under the supervision of the Agricultural Department. When large quantities are required, it seems feasible in most places to get the seed required grown, under contract, for the department, and provided there be careful supervision this is probably better than that the department itself should own and manage large areas for seed growing. The seed farms should be selected in localities which will serve as wide a field as possible in each province.

XI.—SEED DEPOTS.

Even when the department does not grow seed for distribution, great good can sometimes be done by opening depôts where superior seed, purchased in other districts, can be had by cultivators.

UNITED PROVINCES.—The most striking success in this direction has been achieved in the United Provinces where Muzaffarnagar white wheat has been spread over large areas by means of depôts where sales are effected on credit. This system continues to increase in popularity and its extension is only limited by the difficulty of providing responsible supervision. The successful restocking of Bundelkhand with seed after the great famine of 8 years ago indicates what can be done by the use of seed depôts on the lines indicated. Recently the supply for cash of the best local cotton seed available has been successfully carried out by means of temporary village depôts as a result of the famine of 1907-1908. This has been so much appreciated that it is being continued. The best local seed cotton is bought, hand-picked and ginned, the seed being then distributed at bazar rates during the sowing season.

BOMBAY.—In Bombay certain of the experimental farms have been made to serve as seed depôts. This has been particularly the case in connection with the effort to grow Egyptian cotton in Sind and with the extension of Broach cotton cultivation in the Southern Maratha country.

BENGAL.—In Bengal a depôt has been established where the seed of various important crops can be obtained at normal prices. Here the quantity of seed available for a single buyer is limited. The chief sales effected up to date have been to members of the local agricultural associations. The demand for good sound seed from the ryots is, however, likely to increase in the near future.

EASTERN BENGAL AND ASSAM.—A similar central seed depôt has recently been established at Dacca in Eastern Bengal and Assam which stores and supplies the best available seed of the crops of most importance to the province. Seed grown at Government farms is also sold at bazar prices. Seed obtained from outside is selected on the field by an officer of the department and is supplied at cost price. The work of the depôt is rapidly increasing.

MADRAS.—In Madras seed depôts for good and pure cotton seed have been established for several years. So far only fairly large depôts have been maintained, but it is felt that better control could be effected if village agency depôts were started, so that the area and survey numbers of lands to be sown could be noted and checked. The inspection of crops sown with pure seed is a most important point when pure seed is being distributed.

There is no doubt that the establishment of good seed depôts is likely to lead to good results. It is essential, however, that only the very best seed should be stocked and sold and that very complete arrangements for storage should be made. A single distribution of inferior or unsuitable seed is likely to discredit the department. The system adopted in the United Provinces has proved itself satisfactory and is fully described in the *Agricultural Journal of India*, Volume II., Part III.

XII.—COLONISATION WITH EXPERT CULTIVATORS.

In some parts of India there are groups or castes of cultivators particularly skilled in some class of agricultural work. The importation of a body of these men into a new area will generally raise the standard of cultivation in the district to which they are transferred. The diffi-

culty of getting people to leave their own district is, however, in India always great and so the application of this method is decidedly limited. But instances of successful colonisation of backward tracts in this manner have occurred, some of them of very far-reaching effect.

PUNJAB.—The colonisation of the Chenab Colony in the Punjab is the most outstanding example of how agricultural improvement can be effected by the force of example. A large proportion of the land colonised was allotted to the nomads who originally grazed their herds over the whole tract. The rest of the colonists included men from the best agricultural district in the province. The success of the nomad who had no previous knowledge of agriculture, in assimilating the best practices of his neighbours, has been phenomenal. The whole colony is now a tract as well cultivated from an economic point of view as almost any part of India.

At the instance of Sir Edward Buck poudrette farmers were transferred from Farrukhabad to Cawnpore in the United Provinces. Again the Central Provinces Department of Agriculture at a later date imported kachis from Cawnpore to show the cultivators of the province how to use night-soil as a manure, and to some extent their system of cultivation has been adopted by local men.

XIII.—UTILISATION OF INDIVIDUAL EXPERT CULTIVATORS FOR THE INTRODUCTION OF IMPROVED METHODS IN NEW DISTRICTS.

While it is only rarely possible to colonise a backward area with large numbers of better cultivators, it is frequently comparatively easy to induce single men to go to a new tract as employees of the Agricultural Department to show the people the methods in which they are experts.

CENTRAL PROVINCES.—The successful case in which this has been recently done has been already referred to in connection with the introduction of the system of transplanting rice in Chhattisgarh in the Central Provinces. So successful have been the men who were introduced to show the transplanting of rice that some of them are being retained as village kamdars by the malguzars of the villages in which they have been employed.

MADRAS.—Another case in which a slightly different method was adopted may be quoted from Madras. With a view to securing the general adoption of the drill system of cotton cultivation used in the Bellary district, cultivators from Bellary were in the first place taken to the experimental stations belonging to the department and were there used to train the farm coolies in the new system. After the latter were able to carry out the method, they were sent out to villages to train the people.

BOMBAY.—In Bombay similar methods have been adopted. Expert cultivators from Gujarat have been employed to demonstrate their improved methods elsewhere, and expert sugar boilers from near Poona have been sent with excellent results to almost every district in the Presidency where cane is grown to prepare gur by their superior system. It may be added that the gang of sugar boilers employed by the department is in constant demand.

BURMA.—Another case is the employment of Angami Nagas to teach the people of Chin Hills in Burma their methods of terrace rice cultivation.

On the whole there is little doubt of the utility of this method when well considered and well organised.

XIV.—TRAINING THE SONS OF CULTIVATORS.

CENTRAL PROVINCES.—An important departure was made some years ago by starting at the Nagpur Agricultural School a one year's course in practical agriculture for training the sons of farmers. The teaching is given in vernacular and consists almost wholly of practical work on the farm with a minimum of lectures and book work. At the outset it was found very difficult to attract the right stamp of students, although scholarships were freely given by the District Councils. A few sons of cultivators were however attracted with a real desire to learn something connected with their protession. That some measure of success has been secured in these cases has been shown by enquiries into the work they have been doing in the villages after leaving the college. It is found to be very desirable to keep in touch with the students after they have finished their course, to encourage them to write and explain what they are trying, to advise them upon any difficulties that they experience, and to visit them in their home when occasion offers. Some of the passed students are the keenest members of the district agricultural associations.

BOMBAY.—In Bombay, too, but to a very limited extent, the sons of ryots are taken for two years' training on some of the experimental farms. This is rendered possible by the provision of funds by a Bombay gentleman for the purpose.

UNITED PROVINCES.—In the United Provinces an offer is made to teach and train labourers if they are sent to the farms. Wages are paid, but not many usually avail themselves of the opportunity. Courses for cultivators at experimental farms have not been tried systematically, because it is a risky proceeding as they are likely to be more impressed by experimental failures than by experimental successes. Demand exists for similar facilities in the Central Provinces, but only from missionary schools.

EASTERN BENGAL AND ASSAM.—In Eastern Bengal and Assam sons of cultivators are given apprenticeships tenable at the experimental stations. They are required to do manual work on the farms and are trained by the farm superintendents in experimental work for two years, after which they are sent out as demonstrators among their fellow cultivators. It will be seen that experience so far has not been sufficient to indicate how far a demand exists for vernacular instruction by means of short courses at the Agricultural Colleges or at the experimental farms. With suitable precautions the practical training of the sons of ryots might probably be undertaken with advantage, but, at present, it is impossible to lay down what these precautions must be.

XV.—UTILIZATION OF COURT OF WARDS ESTATES.

When zamindari estates are under the management of the Court of Wards, a great opportunity exists for demonstrating improved methods. Systematic efforts are now being made in this direction by the Madras Court of Wards. An expert has been appointed as Agricultural Adviser to the Court. It is his duty to make detailed inspections of the estates under management and draw up a comprehensive programme of what ought to be done to improve the agriculture on the estate. If it is or becomes free from debt, a home farm is usually started at a convenient centre: eight such farms now exist in the Madras Presidency. These are under the executive control of the Agricultural Adviser. Their most important objects are (1) to instruct the ryots of the estate in better methods of agricultural practice and stock-raising, (2) to form an interesting and profitable occupation and hobby for young zamindars when they succeed to their estates.

This method might profitably be followed in such provinces as have large zamindari estates. Even without the appointment of an expert much can be done by Managers of Court of Wards

Estates to improve the agriculture of their districts, and it would be well if this were recognised as an important duty by each Manager.

XVI.—CO-OPERATION BETWEEN OFFICERS OF THE AGRICULTURAL DEPARTMENT AND DISTRICT OFFICERS.

There is large scope for co-operation between the executive officers of Government and those of the Agricultural Department. The District Officer has a close knowledge of his own district, his influence is great among the people and his appointment as president of the local agricultural association at once gives dignity and status to it. His influence is particularly great in connection with all matters where co-operative credit is involved, and these will be more and more important as time goes on. In those provinces where work among cultivators is most highly developed, it has largely been connected with the presence of an enthusiastic or sympathetic district officer. It is therefore important that all officers of the Agricultural Department should keep in as close touch as possible with the district officers and discuss freely with them any proposals they may have for work in the district.

XVII.—GENERAL CONCLUSIONS.

Before proceeding to draw general conclusions on the subject of the present report it will be well to refer to the financial aspect of the question. It is impossible to estimate the value of any method to a cultivator unless account be taken of his financial conditions. Ideas of a ryot's financial condition are often very vague. It is probable that in many parts of India a cultivator does not have any ready capital. He has to borrow every year to meet the expenses of cultivation, and the rates of interest which he has to pay in some provinces are often 24 per cent. and sometimes more per annum. It may not, therefore, be sufficient that a new method involving additional outlay will give a return of 10 to 20 per cent. over the old method. Account must also be taken of the extra capital involved and the rate of interest which the agriculturist will have to pay for this. As the cultivator has no capital he can afford to take no risks. Unless we can show that the new method is a certainty, the cultivator will not take it up. A certainty will mean as a rule to a ryot something which will give him a return of over 25 per cent. on the extra capital invested. The Indian cultivator is not nearly so conservative as is often supposed. He is quick to see any advantage, but there

must be no risk and he must be able to pay for the capital from the results of the new method.

It will be seen, therefore, that the connection between agricultural improvement and the extension of cheap credit is very close, and hence it is vital that there should be collaboration between the department and the co-operative credit organisation. The latter is often the best possible introduction to agricultural improvement. Improvement of agriculture by co-operation and the growth of co-operative credit societies have gone hand in hand in the principal agricultural countries of Europe.

It remains now to summarise the general conclusions which may be drawn from the present report. It is probable that each of the methods which have been considered is adapted to special conditions. It seems certain that if a really good improvement is presented to an Indian agriculturist, he is willing to take it up, provided it is within his means.

The winning of the confidence of the cultivators is the first condition of success. With the spread of primary education it will be possible more easily to win their confidence, and, hence, the extension of primary education is one of the most important of the indirect methods of agricultural improvement. But success depends much more on the personality of the officers and staff of the Agricultural Departments than on any system. At the same time the promotion of a spirit of enquiry among Indian agriculturists must always be kept in view as of great prospective value. As long as the effort is only from above downward, the work of the department cannot be judged a success. There is evidence that in several provinces a considerable number of genuine enquiries are addressed to the department, and the manner of response to these may be productive of much future advantage or the reverse. One great essential is to be sure about the best local practices and to know by careful local investigation why they are used. Thus one is able to ascertain the actual needs of the cultivators, and will be less likely to recommend outside methods which may be improvements, but are not acceptable under local conditions. In the past attention has not always been sufficiently paid to this point. The result has been a suspicion that methods or materials recommended are likely to show unexpected difficulties in practice on the part of cultivators.

Finally it seems desirable that in most cases work in a particular direction should in the first place be concentrated on comparatively small areas where knowledge of what is being done can spread from hand to hand, rather than dissipated over a large stretch of country. Once a method is thoroughly established and recognised as an improvement over a small area, a knowledge of it will usually spread naturally and without much effort over similar areas in the surrounding conntry.

CEYLON AGRICULTURAL SOCIETY.

REPORT, 1909—1910.

MEETINGS.

The last Annual General Meeting of the Society was held on June 8, 1909. The present report deals with the twelve months ensuing since that date. Meetings of the Board were held on August 2, October 18, December 18, 1909, and February 7 and April 6, 1910. A special meeting was held on July 5, 1909, *re* the Tobacco Experiment.

The following were the more important subjects discussed:—Experimental and Model Gardens, the new Rubbers, a Scheme for Education in Agriculture, Plant Breeding, Loan Banks, the Improvement of Tobacco, Spices, Nitrifying Bacteria, Weeds, the position of the Village Farmer, Basket and Mat Making, Cotton Pests.

MEMBERS.

The present roll numbers 931, and though 63 new members joined during the twelve months, the total inclines to remain between 900 and 1,000, chiefly owing to the necessity that arises for removing the names of the inveterate defaulters from the list at the end of each year. The Board is poorer by the death of Messrs. J. Knighton Nock, Simon D. Dabre, Gabriel W. Jayawardene, and B. T. Doole.

Mr. Nock was closely associated with the Society's work, particularly in connection with the organizing of shows, at which his willing and able services will be greatly missed.

The Board has also lost by retirement from the Public Service the Hon. Mr. J. P. Lewis, Mr. F. H. Price, and Mr. Herbert White.

His Excellency the President approved of the following new members serving on the Board:—Rev. Father Paul Cooreman and Mr. S. D. Kristnaratne.

STAFF.

Dr. Willis, Organizing Vice-President, who was absent from the Island on leave since April of last year, resumed duties on February 17 of this year, and relieved Mr. R. H. Lock, who had been acting for him.

The number of Agricultural Instructors remains as before, viz., three for the Sinhalese and two for the Tamil Districts.

The question of appointing additional instructors, who are much needed, is awaiting the elaboration of the scheme for establishing Model and Experimental Gardens. It is very desirable that there should be at least one instructor for each Province.

In addition to the itinerations of the Agricultural Instructors, the Secretary as well as the Officiating Vice-President did a considerable amount of travelling on inspection duty during the year.

In December last the Secretary, accompanied by Messrs. N. Wickremaratne and S. Chelliah, Agricultural Instructors, spent a fortnight in Southern India, visiting, among other places of interest, the Experimental Station at Koilpati and the Sivagiri Home Farm. The short tour was full of interest and instruction, and formed the subject of a special report by the Secretary. Every facility was provided by Mr. Sampson, Deputy Director of Agriculture for the Southern Division, and Mr. Lonsdale, Agricultural Expert to the Court of Wards, for inspecting the farms and gathering all necessary information on the spot with the ready assistance of the farm managers.

BRANCH SOCIETIES.

The Branch Societies as a whole have not furthered the work of the Society to the extent they should have done. Some indeed have been quite dormant, but it is satisfactory to be able to make a good report of others. The lack of activity in the former must be attributed to the want of initiative and enthusiasm on the part of those who constitute the Committee, since it should be quite possible for one Society to do the work that another is doing if the same forces are at work. *Facile princeps* among these branches is the Dumbara Society, of which the Hon. the Government Agent of the Central Province is Patron; Mr. William Dunuwille, Disawa, President; Mr. R. E. Paranagama, Ratemahatmaya, Vice-President; and Mr. C. Rasanayagam, Honorary Secretary and Treasurer. It has a membership of 204 subscribers, and at the end of last year had a fair balance in hand, after meeting the expenses of the year. It is actively interesting itself in the improvement of paddy, cotton, tobacco, fruit, and vegetable cultivation; it holds periodical shows and regular meetings (at a meeting held on March 12 150 members were present), and has done conspicuous work in connection with a co-operative movement, which is referred to elsewhere.

I lately had an opportunity of personally following the Society's operations into the farthest limits of Uda Dumbara, and am convinced that it is working on sound lines, and has succeeded in awakening in the people a practical interest in agriculture. If every branch had as much enterprise and steadiness of purpose as the Dumbara Society, the interests of the agricultural masses would be well looked after.

SHOWS.

Shows were held at Galle, Kegalla, Telijjawila, Mirigama, Hanguranketa, Bellana, Nuwara Eliya, and Pannala. The Galle, Nuwara Eliya, and Kegalla shows were on a large scale. That at Mirigama was purely a school garden show, held under the auspices of the Government Teachers' Union, and proved an unqualified success. The presence of His Excellency the Governor and a number of visitors from Colombo was a great encouragement to both the teachers and scholars who participated in the undertaking. The rest of the shows were on a small scale, and confined entirely to village produce. The value of these purely village shows is now fully recognized, and quite a long list of them appears in the 1910 programme.

EXPERIMENTAL GARDENS.

So far no settled scheme for organizing and financing such gardens has been adopted, and their initiation has hitherto been mainly due to local effort. The gardens at Bandaragama, Weragoda, Balangoda, and Rajakadaluwa began in this way, and have been maintained with some assistance from the Society. In all an attempt is being made to show the best way of cultivating garden crops, and to introduce new varieties of useful plants; but the garden at Rajakadaluwa is also carrying on an experiment in the continuous cultivation of chena crops according to a four-course rotation, consisting of grain, legume, root crop, and cotton, each in turn occupying a fourth of the area given to the experiment, which, as it is continued year by year, should furnish a valuable object-lesson to the cultivator,

On the motion of the Hon. Mr. Kanagasabai a Sub-Committee was appointed to consider a scheme for encouraging model and experimental gardens in the Provinces, to be worked under the supervision of the Society. This Sub-Committee, which has now become a permanent advisory board, drew up a memorandum of conditions, the chief of which is that the Society will contribute an initial grant not exceeding Rs.1,000, and an annual upkeep grant not exceeding Rs. 200 for a period of five years, on the understanding that similar sums will be raised locally. The memorandum has been widely circulated, and applications for grants will be received up to the end of the present half-year.

IMPROVED IMPLEMENTS AND APPLIANCES.

Considerable difficulty has been experienced in inducing native cultivators to adopt any new ideas under this head, but the unfortunate outbreak of rinderpest last year, and the practical extinction of agricultural stock in some parts of the Island, gave the Society an opportunity of going to the assistance of the paddy grower, and at the same time proving the advantages of employing implements and appliances which are labour-saving and do not depend upon the employment of a large number of cattle. For a time the services of the instructors were entirely given to demonstrating the working of light ploughs of the modern type, and through their efforts the critical situation in which the cultivators of the Hambantota District found themselves was relieved. It will be seen from the special report made by the Assistant Government Agent of that district (*vide* Progress Report XLVI.) that he estimated the area that could have been brought under cultivation after rinderpest, with available resources, at 500 acres; but eventually practically the whole irrigable area (some 3,000 acres) was got ready for sowing, and, what is of considerable importance, the ploughed fields gave a better yield, and were prepared for sowing at a cost which was not more than in the case of mudded areas. Altogether the work accomplished at Tissamaharama and elsewhere under very trying conditions was most gratifying, and while acknowledging on behalf of the instructors the complimentary remarks which the Assistant Government Agent passes on their work, I should wish to add that without his active and vigorous co-operation it would have been impossible to carry on the campaign with anything like the success which characterized it.

Demonstrations in the working of implements were also given in the other Provinces of the Island, and definite programmes were carried out in the Kalutara, Kurunegala, and Batticaloa Districts, with the approval and assistance of the respective Revenue Officers.

Another difficulty experienced by cultivators in the rinderpest-stricken areas was the threshing of their paddy. After considerable inquiry a suitable type of machine has been secured in the Mayfurth thresher for hand and animal power, which is found to do faster and cheaper work than is accomplished by the treading of cattle. These machines are likely to become popular, particularly where large stretches of paddy land exists, as at Batticaloa.

TRANSPLANTING IN PADDY CULTIVATION.

Experiments carried out in different localities yielded satisfactory results. The following statement gives the name of the person who undertook the trial, the locality, and the yield of paddy in fold, *i.e.*, the multiple of the quantity used in the nursery. In every case single seedlings were used, and the distance between plants varied from 4 inches to 9 inches :—

Mr. James Wickremaratne, Weligam korale		345-fold
Mr. T. B. Mineriya, Tamankaduwa		366 „
Mr. N. A. S. Jayasuria, Ambalangoda		200 „
Do	do.	288 „
Mr. J. A. Wirasinghe, Rayigam korale		320 „
Do	do	352 „
Do	do	382 „
Do	do	352 „

All but the second of these experiments were inspected by the Secretary or the Agricultural Instructors. The Society is indebted to those who carried them out and thus helped to prove the advantages of transplanting over broadcasting. The fields employed for the purpose of these demonstrations were in nearly every case within easy access by road, and in general appearance, height, fullness of ears, and tillering habit, the crops were conspicuous in their superiority over those of the neighbouring fields.

MANURING OF PADDY.

The following are the comparative results of manuring paddy with a mixture of 2 cwt. bone meal and ½ cwt. nitrate of potash per acre.

The Mudaliyar, Rayigam korale, manured two plots with the mixture and two with bone dust as found in the bazaars; all the plots were of equal size. Two bone-dust plots gave each 30 and 26 bushels, while two others manured with the mixture gave 38 and 36 bushels. In a similar experiment carried out by the Mudaliyar of Gangaboda pattu,

Galle, the yield with bone dust was 19½ bushels, with the mixture 34⅜ bushels.

The Secretary of the Anuradhapura Society reports his results in fold. In one locality, while an unmanured plot gave 7-fold, the manured plot gave 15-fold; in another loclity the results were respectively 24- and 39-fold, under similar conditions.

The Mudaliyar, Wellaboda pattu (Galle), reports that where ordinary bone dust gave 4½ bushels, the mixture gave 13½ bushels.

The Secretary, Dumbara Agricultural Society, reports that Rambukwella Korala of Palispattu got 61 bushels by using the manure, whereas the best lands only gave 32 and ordinary fields 18 to 20. After deducting the equivalent of the manure in paddy, there was still a large excess over normal yields. The Korala's report has been printed and circulated in the Dumbara villages, and the Co-operative Credit Society has resolved to supply manure on the same conditions as paddy.

It is to be regretted that fuller details were not furnished; but in every case equal areas were employed and the same rate of sowing adopted, so that for purposes of comparison the results are quite useful.

COTTON.

The prospects of cotton cultivation may be said to have somewhat improved. Trials in different parts of the Island—Chilaw, Hambantota, Madugoda, &c.—tend to show that Sea Island cotton, if grown at the right season and cultivated in the proper way, can be successfully raised, and produces a lint which is infinitely superior to that of any local variety. Professor Dunstan, who while in Ceylon last March evinced great interest in the possibilities of cotton cultivation, was inclined to think that an improved Upland variety, such as "Black Rattler," should suit local conditions better than any other. Acting on this advice the Society has, with the help of the British Cotton Growing Association, secured a consignment of this seed.

The occurrence of areas that refuse to grow any of the crops successfully raised in other parts of the Island, the opening up of large acreages in coconuts in the dry districts, the depression in the tobacco trade as a result of the enhanced duty on tobacco imported into India, the existence (though to a limited extent) of a spinning and weaving industry, the probability of a reliable local agency being shortly established to act as a medium between the grower and the market, and lastly, the possibility of successfully growing cotton in suitable areas—are all circumstances which favour this cultivation.

The laudable efforts of the British Cotton Growing Association to enconrage cultivators have so far not been attended with the success they deserved. Had an old-established and well-known firm been chosen as the local agents of the Association in the first instance, considerable progress ought by now to have been made. The temporary suspension of ginning operations, and the want of an agency to handle the produce, have acted as a serious set-back, while the extraordinary prosperity of the other agricultural industries of the Island has tended to push any new crop out of consideration.

Of late there has been a revival of the weaving industry through the efforts of the Salvation Army, as well as certain enterprising people in the north of the Island. By the introduction of an improved type of loom the profits on weaving have been considerably enhanced. There is also a fairly big trade in the manufacture of fabrics in the old-fashioned looms still used in Batticaloa, but which have now been practically abandoned in Chilaw.

In Upper Dumbara the weaving industry has shrunk to the narrowest limits, and the outturn of the loom depends chiefly on the fostering care of the Kandyan Art Association. The materials manufactured are coarse in texture and have no commercial standing, but their quaintness fetches for them a fictitious value as curiosities. There is, however, here an opportunity for reviving cotton cultivation, since cotton growing and spinning are still carried on on a small scale, so that any development in weaving could go hand in hand with extension of cultivation. Through the efforts of the Dumbara Agricultural Society an experiment in growing Sea Island cotton was undertaken, and gave encouraging results; and as this body is following up its first experiment, and is also considering the question of introducing a better type of loom, there is some prospect of the trade in Kandyan woven cloths being re-established on a business footing.

TOBACCO.

Ceylon-grown tobacco is utilized for the manufacture of cigars or for chewing purposes. The bulk of the chewing tobacco hitherto found a ready market in Travancore State. In spite of periodic fluctuations due to overstocking, the industry has always been admitted to be a thriving one, and practically the

only source of agricultural revenue to the Tamils of the North. Within the past few months a serious check has been experienced by tobacco growers in consequence of the Indian Government raising the import duty on tobacco from Rs. 90 to Rs. 900 per candy. So far as Ceylon is concerned the new tariff has practically killed the trade in chewing tobacco, and the grower of this leaf, which is raised on a particular type of soil, is much exercised in mind as to what can take the place of the tobacco crop. Cotton is likely to do, and the Society is taking advantage of the situation to encourage cotton cultivation in the North, but at present the tobacco grower is inclined to look askance at any product that will not yield him the magnificent returns that tobacco does. The Society, in the meantime, has embarked upon a comparatively big enterprise with a view to proving the possibility of turning out an improved smoking tobacco for the foreign market. The system of cultivation practised at present results in the production of a large coarse leaf, while the method of curing induces a rank tobacco only fit for the manufacture of a crude form of cigar for local consumption. By the employment of superior seed, a better system of cultivation and harvesting, and an improved method of curing, it is hoped that the object sought will be attained. The scene of the tobacco experiment is the Experiment Station at Maha Iluppalama, where 50 acres of land were made available by the Botanic Department for the purpose. The Society voted a sum of Rs. 27,000, and Government contributed half the cost of the salary of the expert (Mr. Edward Cowan). Operations began practically at the commencement of the year, and reports of progress have so far been satisfactory. Mr. Breckenridge, Agricultural Instructor, has been sent on special duty as conductor under Mr. Cowan, with whom the Superintendent of the Experiment Station (Mr. Harbord) is co-operating. Both Sumatra and Java tobacco are being tried.

In Trincomalee the Messrs. Molesworth Bros. have been carrying on tobacco cultivation on improved lines, and are now turning out a cigar of a superior type, with which they are trying the market.

School Gardens.

The Society has done much to push on the work of the School Garden Department, which is making very satisfactory progress. With the exception of a handful of teachers of the old school, who are nearing their time of retirement, there is a general desire on the part of school masters to work under the scheme, and in most cases with gratifying results. The advantages of the education which the scheme provides to the rising generation in the rural districts are undeniable, and its influence upon village life and character is material. Under these circumstances it would be a wise policy to gradually develop this department by additions to the staff as well as to the votes, so that the scheme may ultimately embrace all the schools of the Island. At present it is impossible to grant aid to the extent that it is demanded by both Government schools and those under private management.

Loans to Cultivators.

The Committee appointed by His Excellency the Governor to report on this subject have sent in their recommendations (*vide* Sessional Paper VIII. of 1910), the more important of which are that an Ordinance be introduced on the lines of the Indian Co-operative Society's Act, No. X. of 1904, by which societies formed in Ceylon can be corporated; that the accounts of the societies should be submitted for Government audit; that there should be joint and unlimited liability of the members; that Government should allow similar fiscal, legal and executive privileges to societies as in India; that where necessary financial aid will be rendered by Government, but that in no case should monetary grants be given unless a sum equal to that asked for be first raised by the members.

These recommendations have still to come into effect, but in the meantime some attempts are being made by local societies to go to the aid of the cultivator by means of loans of paddy and manure, and in some cases of small sums of money. The most successful of these is the movement set on foot by the Dumbara Branch, and as it is the first local body that has launched so far in this enterprise, a report on the working of the Co-operative Credit and Loan Society is given below for the information of other branches :—

This Society was started in August, 1906, with 22 members and a deposit of Rs. 420. Since then the increase in membership and deposits has been as follows :—

	Rs.
On December 31, 1906, there were 37 members with a deposit of ..	670
On December 31, 1907, there were 43 members with a deposit of ...	740
On December 31, 1908, there were 49 members with a deposit of ...	810
On December 31, 1909, there were 69 members with a deposit of ...	1,000

The increase of membership during 1907 and 1908 was 6 and 7 respectively. The increase for the year under review was 15.

Meetings.—A general meeting and six committee meetings were held during the year.

Finance.—Balance on January 1, 1909:—

	Rs. c.
Cash	712 60
Paddy	140 0
Reserve Fund	38 31
Paddy bin	45 0
	935 91
Deposits during the year ...	190 0
Interest on cash loans ...	76 60
Interest on paddy loans ...	42 80
	1,245 31
Expenses during the year: interest paid	32 40
Balance...	1,212 91

	Rs. c.
Cash	816 60
Paddy	226 0
Reserve Fund	170 31
Total...	1,212 91

Cash Loans.—

	Rs. c.
In 1907 loans were made to 11 persons amounting to	550 0
In 1908 loans were made to 15 persons amounting to	750 0
In 1909 loans were made to 19 persons amounting to	950 0

Of these, only one loan of Rs. 50 made to the Arachchi of Ambale has not yet been recovered. Two other loans made in 1908 were renewed in 1909 on payment of interest.

Paddy Loans.—

	Bushels.
In 1906 loans were made to 42 persons amounting to	50
In 1907 loans were made to 53 persons amounitng to	$76\frac{1}{2}$
In 1908 loans were made to 50 persons amounting to	$95\frac{1}{2}$
In 1909 loans were made to 87 persons amounting to	$131\frac{1}{2}$

All the paddy lent out has been returned with interest.

Many applications for loans in paddy as well as in cash had to be refused for want of funds. The utility of the Society can be greatly increased if its finances will allow of it. Many applications had also to be refused for want of security. If Government can be induced to grant loans to the Society and to give a legal status to the Society by creating a first charge on the produce of the land of the borrower, the Society will be able to extend its benefits to many who cannot be reached and helped by it as presently constituted.

The thanks of the Society are due to the caretakers and distributors of paddy at Madugoda aud Mediwaka.

At the end of the year 1909 there was a balance of Rs. 87 to the credit of the Society, and the amount as allowed by the rules will be transferred to the Reserve Fund.

The Dumbara Agricultural Society and the Co-operative Credit Society of Dumbara.

BALANCE SHEET, 1909.

Cash Account.

	Rs. c.		Rs. c.
Balance	611 33	Loans made in cash ...	804 60
Fresh deposits during the year ...	190 0	Interests paid on deposits ...	18 47
Loans repaid during the year ...	710 0	Stamps and stationery ...	2 40
Vegetable seeds sold ...	9 50	Vegetable seeds and mango plants purchased	15 80
Mango plants sold ...	8 15	Subscription to Ceylon Agricultural Society	8 0
Agricultural Society's subscriptions	50 0	Amount deposited in Savings Bank	450 0
Interest received	76 60	Balance in hand	356 31
	1,655 58		1,655 58

Paddy Account.

	Bus. Lahas.		Bus. Lahas.
Balance	101 6	Paddy loans outstanding ...	116 2
Borrowed from Appuhamy, Registrar	2 0	Balance in store ...	9 0
Interest recovered ...	21 6		
	125 2		125 2

Profit and Loss Account.

	Rs. c.		R. c.
Interest paid to depositors ...	32 40	Interest received on cash loans ...	76 60
Net profit	87 0	Interest received on paddy loans, 21·6 bushels	42 80
	119 40		119 40

Reserve Fund Account.

	Rs. c.		Rs. c.
Balance	170 31	Balance	38 31
		A paddy bin	45 0
		Net profit	87 0
	170 31		170 31

Balance Sheet.

	Rs. c.		Rs. c.
Deposits	1,000 0	A paddy bin	45 0
Agricultural Society's Funds ...	137 79	Paddy in two stores, 123 bushels ...	226 0
Agricultural Show Funds ...	107 21	Loans outstanding	348 40
Interest due to depositors ...	60 40	Deposit in Ceylon Savings Bank ...	500 0
Reserve Fund	170 31	Cash in hand	356 31
	1,475 71		1,475 71

C. RASANAYAGAM,
Honorary Secretary and Treasurer.

FODDER AND STOCK.

Until there is a rational relation between the number of cattle and the fodder supply the nuisance of cattle trespass will continue. The practice of cultivating special crops for fodder, as is done in India, has yet to be adopted by native cattle owners; the absence of suitable pasture lands only tends to intensify the evil of cattle trespass. One of the members of the Board is giving a trial to Sorghum as a fodder crop, and his experience should be of assistance to others who have been thinking of cultivating such crops.

The Society has been trying a number of fodder plants likely to suit local conditions, such as the locust bean, Algaroba bean, chou-moellier, and Congayam grass. The last mentioned (*Pennisetum cenchroides*) is likely to prove an acquisition in the dry parts of the Island.

APICULTURE.

Bee-keeping on modern lines continues to make progress, and the demand for hives is steady though slow. The tendency among amateurs is to keep to native bees, as the European strains require so much attention in the way of feeding, &c. Messrs. A. P. Goonetilleka of Veyangoda and J. V. Perera of Colombo are giving close attention to the training of *Apis indica*, and have succeeded in inducing them to store pure honey in a super. Mr. Perera, who agrees with Mr. Shanks as to the value of *Pterocarpus indicus* in the honey-flow, lately extracted some excellent honey with the aid of the Cowan extractor. At Pinnawela school bee-keeping has been taken up by the boys.

SERICULTURE.

There are no startling developments to report under this head. With the advice of the Sericulture Committee the Society has been co-operating with the Indian authorities in order to develop eri silk culture. Machines for cleaning the cocoons and for spinning have been secured through the assistance of the Imperial Entomologist for India, also a pure strain of silk-worms which are bred at the Stock Garden to keep up a supply of eggs. It is hoped that before long a fair market rate will be offered as the result of a compromise between European and Indian firms. The Tata Silk Farm at Bangalore has been taken over by the Salvation Army, and with the interest which Major Booth-Tucker is taking in this matter, it may be expected that more rapid progress will follow. Writing to the Secretary in April, Major Booth-Tucker mentions that he is just setting out on a tour through Europe, the main object of which is to find the best markets for silk and to secure the services of experts. Samples of eri cocoons raised in Ceylon are being forwarded to him.

PUBLICATIONS.

The "Tropical Agriculturist and Magazine of the Ceylon Agricultural Society," the "Govikam Sangarawa," and the "Kamat Tholil Velakkam" continue to serve the interests of the Society's members as the monthly English, Sinhalese, and Tamil publications respectively.

The occasional publications consist of the calendar and leaflets on special subjects of importance to agriculturists.

AGRICULTURAL EDUCATION.

The absence of any provision for regular agricultural training, and the difficulty of gaining admission to Indian Colleges, place Ceylon boys at a great disadvantage. The Committee appointed by His Excellency the Governor to report on a proposed scheme of agricultural training for Ceylon have made their report (Sessional Paper XXXVII. of 1909) embodying practical proposals, which, it is to be hoped, will soon come into effect.

ANALYSES AND REPORTS.

A perusal of the information published under this heading in the Progress Reports will give some idea of the inquiries and investigations that have been carried on. In this work the Society has had the fullest co-operation of the Government Agricultural Chemist. Willing and ready advice on the subject of insect pests has always been available from the Government Entomologist, while for the identification of plants thanks are due to the Curator of the Royal Botanic Gardens.

THE IMPERIAL INSTITUTE.

The visit of Professor Dunstan, Director of the Imperial Institute, during the first quarter of the year gave those who are closely connected with the agricultural work of the Colony an opportunity of discussing local problems with one, who, from his official relations with all the British Colonies, has had exceptional opportunities for studying the affairs of the tropics. It is only a want of time that prevented him from attending one of the meetings of the Board and addressing its members.

The Secretary has been appointed Secretary to a small committee which is collecting samples of agricultural and industrial products to fill up gaps in the collection at the Imperial Institute, London.

Professor Dunstan, before leaving Ceylon, authorized the Secretary to notify to members of this Society that he will be pleased to examine and report on promising samples forwarded through the Ceylon Agricultural Society.

MUSEUM AND READING ROOM.

The Secretary has gradually got together a fairly large collection of local and Indian products which should form the nucleus of an agricultural museum, an institution which is a much-felt want in Colombo both by residents and visitors. The question of suitably housing the exhibits has yet to be settled. With a museum might appropriately be associated a library and reading room. The Society has even now a good stock of books of reference, and also receives as exchanges almost all the agricultural publications of the world.

ACKNOWLEDGMENTS.

The thanks of the Society are due to Government for the continuance of its annual grant; to His Excellency the Governor, its President, for identifying himself with the work of the Board; to the Organizing Vice-President and Editor of the Society's Journal (Dr. Willis), for being the medium of a happy co-operation between his own Department and this Society; and to the Revenue Officers and their headmen for their assistance in furthering the Society's work in the Provinces.

The Secretary desires to commend to the Board the two Agricultural Instructors who have shown the greatest aptitude, viz., Mr. N. Wickremaratne and Mr. S. Chelliah.

C. DRIEBERG,
Colombo, June 8, 1910. Secretary.

PERADENIYA EXPERIMENT STATION.

MEETING OF MAY 12, 1910.

Minutes of a Meeting of the Committee of Agricultural Experiments held at the Experiment Station, Peradeniya, on 12th of May, 1910.

The following members were present:—Dr. Willis, Chairman, the Govt. Entomologist, the Government Chemist, the Hon'ble Mr. E. Turner, Messrs. Rosling, Fraser, Jowitt, Anderson, Vanderstraaten, and the Secretary.

The Secretary read the Progress Report since the previous meeting, and the following resolution was passed unanimously :—

Proposed by Mr. Rosling and seconded by Mr. Bamber : "That Mr. N. W. Davies of Portswood, Kandapola, be asked to fill the vacancy on the Committee of Agricultural Experiments caused by the resignation of the Hon'ble Mr. J. N. Campbell."

J. A. HOLMES,
Secretary, C. A. E.

PROGRESS REPORT ON EXPERIMENT STATION FROM 10TH MARCH TO 12TH MAY.

TEA.—The *Indigofera* sown in plot 142 has been cut twice since the last meeting; on the first occasion the yield was 1,367 lbs. (March 18th) and on the second 468 lbs. (April 29th); this brings the total for the year up to 4,123 lbs.

In plot 147 the *Crotalaria striata*, which had previously been unsuccessfully bent to see if it would cover the surface of the soil, was cut for the first time on April 28th and weighed 1,194 lbs.

Crotalaria striata on plot 148 has been twice cut since the last meeting, and the weight of the two crops equalled 1,893 lbs., making a total for four months of 2,044 lbs.

In order to smother *Tora* weed which is becoming very troublesome on some of the tea plots, *Crotalaria* has been sown on plot 151, and residue of lemon grass after distillation is being thickly mulched on the dirty patches from 152-155; hand weeding has also been resorted to in order to eradicate the bulbous roots.

The yield of green leaf for the week ending May 7th was considerably in excess of anything previously recorded, 2,044 lbs. having been despatched to Peradeniya Factory.

The bushes are still being plucked to the whole leaf, but experiments are being made on certain bushes as to the growth of new flush from whole and fish leaf plucking.

CACAO.—The dadaps in the young cacao have been pruned, the weight of leaf, etc., thus available for mulching around the plants being as follows:—In the two low shade plots 747 and 1,283 lbs., and in the high shadeplot 719 lbs., the fourth plot has had the branches bent as before.

Supplies have been planted and shaded and are progressing favourably.

In plots 1-10 all the lower branches of the shade trees (dadaps) have been lopped.

All the experimental plots have been manured up to date.

There has been a remarkably heavy blossom all round during the last three weeks.

14½ cwts. of cacao was sold by auction on 4th April at the rate of Rs. 41 per cwt.

COCONUTS.—The oil experiment decided on at the last meeting has given the following result for fresh nuts:—

	lbs.
Weight of Husks and Nuts...	1,281
500 Husks	659¼
Nuts	622¼
Water	67
Split shells	553¼
Shells	190
Copra	193
Oil	106
Poonac	60
No. of days drying ...	7.

Of the ten acres of young coconuts over five have been drained and one has been planted with *Tephrosia candida* seed.

On the coconut land selected for fruit experiments all the palms have been felled, but have not so far been removed.

Statistics as to their fruit and leaves are appended,

The price for coconuts realised at the sale on 4th April was Rs. 46 per 1,000 all round.

RUBBER.—*Para.*—The following results in latex have been obtained from the various methods of tapping for the last 17 days, during which period the latex from the trees from each row has been bulked;—

Full herring bone	...	49 cc.
Left to right ½ sp.	...	42 ,,
Right to left ¼ sp.	...	53 ,,
Vertical channels pricked		108·2 ,,

Three trees have collapsed as the result of thumb nail pruning, although no severe winds have been experienced.

Measurements of trees were taken in March the 11th to the 16th to ascertain the effect of rain on the girth. Rain fell for two hours on March the 14th, and measurements taken three hours later showed an increase of ⅛″ to ¼″. Further measurements taken the following morning showed the girths had again fallen to the normal, and in some instances further decreased by ⅛″.

Ceara.—No further tapping experiments have been tried on Ceara as the trees are not yet recovered from wintering; despite the lack of leaf the bark appears to be renewing in a most satisfactory manner, and is full of latex.

M. Dichotoma.—Four further losses from wind in the 20-month old plot have been recorded.

PADDY.—The paddy land has been prepared for the Hineti crop which will not be transplanted but will be manured as before.

COFFEE.—Land has been made ready for the purpose of growing more extensive plots of *Coffea Robusta* and

Liberica, seedlings of which are at present thriving in nurseries.

The various varieties all blossomed towards the end of March.

TOBACCO.—About one-quarter of an acre of Dumbara tobacco has been planted out and shaded.

SUGAR.—Sugar-canes from Java have been planted at the request of a gentleman who is desirous of introducing the best varieties into India, and who thought that the best means of propagation would be to temporarily plant them in Ceylon.

MAIZE.—A small quantity of maize has been sown at the request of Mr. Drieberg in order to supply seed for the School Gardens.

GREEN MANURES.—The following leguminosæ were cut and yielded :—

Cajanus indicus ...	9,200	lbs. per acre
Tephrosia hookeriana	1,700	,, ,, ,,
Mimosa pudica ...	10,700	,, ,, ,,

Beds of *Crotalaria incana and striata, Indigofera hirsuta*, and *Tephrosia purpurea* have been sown ; also one acre of *Tephrosia candida* in the young coconuts and about one-quarter acre of *T. hookeriana* in rubber.

GRASS.—About 1½ acres of land have been cleared of Lantana, etc. and planted with Guinea grass.

OIL GRASS.—*Cymbopogon Martinii* has been uprooted and planted out, about 70 plants are now living and the seed gives promise of being fertile.

A large plot of *Lena Batu* has been planted.

A shipment of two dozen bottles *Andropogon citratus* oil has been made to London.

FRUITS.—The plantains are progressing very well, as are the pineapples.

Some cashew-nut seeds sown in the nurseries have also germinated satisfactorily.

The coconut land decided on for fruit experimental purposes will be ready for planting in the middle of June.

NURSERIES.—Teak seed from Java has been sown.

PEPPER.—The best varieties of pepper vine have been ordered from the Director of Agriculture, Madras.

WASH.—The following are the weights of wash on the various plots :—

Desmodium triflorum ...	30	lbs.
Mixed Crotalarias ...	176	,,
Dadap stumps ...	330	,,
Blank	814	,,
Crotalaria incana ...	309	,,
Albizzia plants ...	168	,,
Crotalarias across slope ...	50	,,
Plain deep forking ...	1,393½	,,
Ipomea	133	,,

VISITORS.—134 visitors, including the Director of Agriculture, Bombay, have visited the Experiment Station during the last two months.

J. A. HOLMES,
Supt. Experiment Station, Peradeniya
12th May, 1910.

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Monthly Prices Current, London, 11th May, 1910.)

	QUALITY.	QUOTATIONS.
ALOES, Socotrine cwt.	Fair to fine ...	80s a 85s
Zanzibar & Hepatic ,,	Common to good ..	40s a 70s
ARROWROOT (Natal) lb.	Fair to fine ..	7d a 8d
BEES' WAX, cwt.		
Zanzibar Yellow ,,	Slightly drossy to fair ..	£6 15s a £6 17s 6d
Bombay bleached ,,	Fair to good	£7 7/6 a £7 12s 6d
,, unbleached ,,	Dark to good genuine. ..	£5 15s a £6 10s
Madagascar ,,	Dark to good palish	£6 15s a £7
CAMPHOR, Japan ,,	Refined	1s 6d a 1s 7¼d
China ,,	Fair average quality ...	145s
CARDAMOMS, Tuticorin	Good to fine bold	2s a 2s 5d
	Middling lean	1s 9d a 1s 10d
Tellicherry	Good to fine bold ..	2s a 2s 3d
	Brownish ..	1s 3s a 1s 9d
Mangalore ,,	Med brown to fair bold	2s a 2s 11d
Ceylon.- Mysore ,,	Small fair to fine plump	1s 4d a 2s 10d
Malabar ..	Fair to good ...	1s 3d a 1s 4d
Seeds, E. I. & Ceylon ,,	Fair to good ..	1s 7d
Ceylon Long Wild ,,	Shelly to good ..	6d a 1s 7d
CASTOR OIL, Calcutta ,,	Good 2nds .	3¾d
CHILLIES, Zanzibar cwt.	Dull to fine bright ...	40s a 45s
CINCHONA BARK.– lb.		
Ceylon	Crown, Renewed	3⅝d a 7d
	Org. Stem	2d a 6d
	Red Org. Stem	1¾d a 4¼d
	Renewed	3d a 5¼d
	Root	1⅞d a 4d
CINNAMON, Ceylon 1sts	Good to fine quill	6½d a 1s 5d
per lb. 2nds	,, ,,	5¾d a 1s 4d
3rds	,, ,,	5d a 1s
4ths	,, ,,	4½d a 8½d
Chips, &c..	Fair to fine bold	2¼d a 3d
CLOVES, Penang lb.	Dull to fine bright pkd.	1d 5s a 1s 6d
Amboyna ..	Dull to fine	9d a 10d
Ceylon ..	,, ,,	9d a 10d
Zanzibar	Fair and fine bright	5d a 5½d
Stems ..	Fair	2d
COFFEE		
Ceylon Plantation cwt.	Medium to bold	65s a 100s
Native	Good ordinary	nominal
Liberian ,,	Fair to bold	43s a 55s
COCOA, Ceylon Plant. ,,	Special Marks	57s 6d a 70s
	Red to good	52s 6d a 56s
Native Estate ,,	Ordinary to red	37s a 50s
Java and Celebes ,,	Small to good red	30s a 80s
COLOMBO ROOT ,,	Middling to good	30s a 35s
CROTON SEEDS, sift. cwt.	Dull to fair	45s a 47s 6d
CUBEBS ,, ,,	Ord. stalky to good	150s a 170s
GINGER, Bengal, rough ,,	Fair	40s nom.
Calicut, Cut A ,,	Small to fine bold	65s a 85s
B & C ,,	Small and medium	55s a 60s
Cochin Rough ,,	Common to fine bold	45s a 50s
	Small and D's	42s 6d a 45s
Japan ,,	Unsplit	43s
GUM AMMONIACUM ,,	Sm. blocky to fair clean	35s a 73s 6d
ANIMI, Zanzibar	Pale and amber, str. srts.	£15 a £16
	,, ,, little red	£12 a £14
	Bean and Pea size ditto	75s a £13 10s
	Fair to good red sorts	£8 a £12
	Med. & bold glassy sorts	£6 a £8
Madagascar ,,	Fair to good palish ...	£4 a £8 15s
	,, ,, red ..	£4 a £7 10s
ARABIC E. I. & Aden ,,	Ordinary to good pale	25s a 32s 6d nom.
Turkey sorts ,,		32s a 50s
Ghatti ,,	Sorts to fine pale ...	20s a 42s 6d nom.
Kurrachee ,,	Reddish to good pale ...	20s a 30s ,,
Madras ,,	Dark to fine pale ...	15s a 25s ,,
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	£18 15s a £20 15s
	com. stony to good block	15s a £8
KINO	Fair to fine bright	6d a 9d
MYRRH, Aden sorts cwt	Middling to good	55s a 65s
Somali ,,	,, ,,	50s a 55s
OLIBANUM, drop ,,	Good to fine white	45s a 60s
	Middling to fair	30s a 40s
pickings ,,	Low to good pale	10s a 25s
siftings ,,	Slightly foul to fine	16s a 20s
INDIA RUBBER lb.	Fine Para bis. & sheets	10s 3d
	,, Ceara ,, ,,	9s
Ceylon, Straits, Malay Straits, etc.	Crepe ordinary to fine..	10s 7d a 10s 10d
	Fine Block ..	11s
	Scrap fair to fine ..	8s 4d a 8s 6d
Assam	Plantation ..	6s 6d
	Fair II to ord. red No. 1	5s 10d a 6s
Rangoon	,, ,,	4s a 4s 9d

	QUALITY.	QUOTATIONS.
INDIARUBBER. *(Contd.)*		
Borneo	Common to good	3s 3d a 4s 6d
Java	Good to fine red .	5s 6d a 5s 9d
Penang	Low white to prime red	3s 3d a 4s 6d
Mozambique	Fair to fine red ball ...	7s a 8s 6d
	Sausage, fair to good ..	6s 10d a 8s 3d
Nyassaland	Fair to fine ball ...	6s a 7s 2d
Madagascar	Fr to fine pinky & white	5s a 6s 2d
	Majunga & blk coated ..	3s 6d a 4s
	Niggers, low to good ..	2s a 4s
New Guinea	Ordinary to fine ball ..	4s 6d a 6s
INDIGO, E.I. Bengal	Shipping mid to gd violet	2s 10d a 3s 8d
	Consuming mid. to gd.	2s 6d a 2s 10d
	Ordinary to middling	2s 2d a 2s 5d
	Oudes Middling to fine	2s 6d a 2/8 nom.
	Mid. to good Kurpah	2s 2d a 2s 6d
	Low to ordinary	1s 6d a 2s
	Mid. to fine Madras	1s 5d a 2s 4d
MACE, Bombay & Penang	Pale reddish to fine	1s 11d a 2s 4d
per lb.	Ordinary to fair	1s 8d a 1s 10d
Java	,, ,, good pale	1s 7d a 2s
Bombay	Wild	3½d a 4½d
MYRABOLANES, cwt	UG and Coconada	5s a 5s 6d
Bombay ,,	Jubblepore	5s a 6s
	Bhimlies	5s 3d a 6s 6d
	Rhajpore, &c.	4s 9d a 5s 6d
Bengal ,,	Calcutta	5s 6d a 6s
NUTMEGS— lb.	64's to 57's	1s a 1s 6d
Bombay & Penang ,,	110's to 65's	4¾d a 1s
	160's to 115's	4d a 4½d
NUTS, ARECA cwt.	Ordinary to fair fresh	14s a 15s
NUX VOMICA, Cochin	Ordinary to good	9s a 11s 6d
per cwt. Bengal	,, ,,	6s 6d a 7s
Madras	,, ,,	6s 9d a 8s
OIL OF ANISEED ,,	Fair merchantable	4s 6d
CASSIA ,,	According to analysis	3s 4d a 3s 8d
LEMONGRASS ,,	Good flavour & colour	2¾d
NUTMEG ,,	Dingy to white	1½d a 1¾d
CINNAMON ,,	Ordinary to fair sweet	2d a 1s
CITRONELLE ,,	Bright & good flavour	1s
ORCHELLA WEED—cwt		
Ceylon ,,	Mid. to fine not woody...	8s a 10s
Madagascar ,,	Fair ...	10s
PEPPER– (Black) lb.		
Alleppy & Tellicherry	Fair ..	3⅞d
Ceylon	,, to fine bold heavy ..	3¼d a 4⅛d
Singapore ...	,, ...	4d
Acheen & W. C. Penang	Dull to fine	3½d a 3¾d
(White) Singapore ,,	Fair to fine	6¼d a 8d
Siam ,,	Fair	6¾d
Penang ,,	Fair	6¼d
Muntok ,,	Fair	7d a 7⅛d
RHUBARB, Shenzi ..	Ordinary to good ...	1s 2d a 2s 6d
Canton ..	Ordinary to good ..	10¼d a 1s 1d
High Dried..	Fair to fine flat ..	9½d a 11d
	Dark to fair round ..	5d a 6½d
SAGO, Pearl, large ..	Dull to fine .. .	22s a 24s
medium ..	,, ,,	20s a 22s
small ...	,, ,,	18s 6d a 20s
SEEDLAC cwt.	Ordinary to gd. soluble	45s a 60s
SENNA, Tinnevelly lb.	Good to fine bold green	4½d a 7d
	Fair greenish	2¾d a 4¼d
	Commonspeckyand small	1½d a 2¼d
SHELLS, M. o'PEARL—		
Egyptian cwt.	Small to bold ..	29s a 137s 6d
Bombay ,,	,, ..	27s a 135s nom.
Mergui ,,	,, ,, ...	£5 17/6 a £9 7/6
Manilla ,,	Fair to good ..	£7 7/6 a £10 2/6
Banda ,,	Sorts	25s a 30s nom.
TAMARINDS, Calcutta...	Mid. to fine bl'k not stony	11s a 12s 6d
per cwt. Madras	Stony and inferior ..	4s a 5s
TORTOISESHELL—		
Zanzibar, & Bombay lb.	Small to bold ..	11s a 29s
	Pickings ...	8s a 23s
TURMERIC, Bengal cwt.	Fair .	19s 6d
Madras ,,	Finger fair to fine bold	23s a 24s 6d
Do. ,,	Bulbs [bright	17s a 18s
Cochin ,,	Finger .	20s
	Bulbs ..	14s 6d
VANILLOES— lb.		
Mauritius ... 1sts	Gd crystallized 3½ a 8½ in	13s a 18s
Madagascar ... 2nds	Foxy & reddish 3½ a ,,	11s 6s a 14s
Seychelles ... 3rds	Lean and inferior ...	10s 6d a 11s
VERMILLION ..	Fine, pure, bright .	3s 2d
WAX, Japan, squares	Good white hard ...	40s

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THE TOBACCO TROUBLE IN TRAVANCORE.

HOW WILL IT BE SOLVED?

We learn from South India that the recent impost on tobacco levied by the Travancore Durbar in conformity with the rate of tax fixed by the Imperial Government has proved to be a serious drain on the tobacco traders of the State and is likely to ruin them. The system under which the trade is carried on is explained in the last Travancore Administration Report:—

"The tobacco required for consumption in the State is imported by merchants on their own account, by land, sea or rail, and bonded in Sirkar warehouses, where it is allowed to remain in the joint custody of the Durbar and the merchants. The merchants remove the tobacco from the warehouses after paying the import duty of R90 per candy for all kinds."

It has always been the policy of the Travancore Government to encourage and foster the tobacco trade, and at one time nearly half the revenue of the State was derived from the tobacco trade of which the Government had the monopoly. Subsequently the Government monopoly was abolished, and the trade was thrown open to public competition. The import duty on Ceylon tobacco was then fixed at R190 per *candy*. Having realised by experience that so high a duty as R190 per *candy* on Ceylon tobacco was injurious to the trade and to the best interests of the State, the Government reduced the import duty on Ceylon tobacco to R90 per *candy* at which rate it remained till February 25th last. The solicitude which the Government had for the growth of the trade was so great that with a view to encourage tobacco merchants and prevent smuggling, warehouses on different trade routes and at convenient centres for storing tobacco were placed at the disposal of the traders. As will be seen from the quotation given above, this practice prevails even now. Another concession which tobacco traders enjoyed has been the privilege of paying the duty on tobacco by degrees as sales were gradually effected. The tobacco being kept in bonded warehouses under the care and supervision of Government Officials, the traders have been at liberty to sell at their convenience, and after each sale to pay the duty on the quantity sold—a privilege not enjoyed by tobacco traders elsewhere. They were also encouraged to import all the tobacco they could afford to buy during the season of the North-East Monsoon when alone the Travancore ports are available for safely landing goods, and to keep it in the bonded warehouses. The peculiarity with the Ceylon tobacco is that Travancore and Cochin are the only countries where it is principally consumed. In Travancore it is used by all classes of the native inhabitants as an almost indispensable ingredient in chewing betel. The average consumption per head of the population last year was 4·2 lb. against 4 lb. in the year previous. The way in which the Ceylon tobacco is cured and prepared is highly relished by Travancoreans who consider it an antidote to the evil effects of malaria and the dampness of the climate. The traders in Travancore have invested a large amount of capital in the purchase of Ceylon tobacco and in making advances to tobacco cultivators in the district of Jaffna in Ceylon where this variety of tobacco is exclusively grown. The total capital invested this year alone is R16 lakhs. They have also in stock in the Government warehouses in Travancore 2,600 and odd *candies* of tobacco valued at R5½ lakhs, and they have now in Ceylon, ready for shipment, 1,500 and odd *candies* valued at about R3 lakhs. The newly-levied duty is R1 As 8 per pound of tobacco which is R900 per *candy*. This huge enhancement at one sweep is

a crushing tax which has already affected the tobacco trade. The merchants who have stored tobacco to the value of several lakhs are already in difficulties. On account of the terribly high and prohibitive price now put on tobacco the trade in Ceylon tobacco has come to a standstill, and the merchants have begun to sustain a heavy loss. The only result, if the present state of affairs should continue, is the complete ruin of about a dozen rich and influential merchants who have long been trading in Ceylon tobacco.

There is another point worthy of mention. In the district of Jaffna a large Colony of about 50,000 people has been carrying on the cultivation, manufacture and export of Ceylon tobacco for the past several decades. If the rate of duty is to remain as it is at present, there will be complete annihilation of the trade and total ruin of the tobacco colony in the island of Ceylon also. The Travancore Government have notified that the new tax would be levied from the 25th February last, *i.e.*, with retrospective effect for about six weeks. In other words, the retrospective clause has been made applicable to tobacco imported months and years ago and lying in the Government warehouses on which duty has not yet been paid, in spite of the fact that the Travancore Government had offered several inducements to the merchants to buy Ceylon tobacco and store it in warehouses under the custody both of the Government and of the merchants. And the merchants had themselves no previous intimation about the enhanced tax or its retrospective application. The request of the merchants is threefold:—In the first place, they want that on Ceylon tobacco imported and stored in the Government warehouses before the 25th February, 1910, no higher duty than R90 be levied per *candy*. Secondly, they pray that Government should grant them permission to import at once on the same terms as before the tobacco already bought by them and now ready for shipment. They have purchased tobacco worth about R3 lakhs. They further add that, this being the shipping season, this concession be granted as early as possible. Thirdly, they implore the Government that they will be pleased to cancel the new impost and revert to the original duty of R90 per *candy*.

There is another aspect of the matter, *viz.*, that of revenue to the State. The finances of the State are not in a flourishing condition. It has not yet emerged safely and steadily from years of deficits. As shown below the excess of expenditure over income was for the

		R.
year 1902	...	2,67,073
Do 1903	...	9,61,481
Do 1904	...	4,22,467
Do 1905	...	7,95,518
Do 1906	...	9,19,701
Do 1907	...	2,03,662
Total for these 6 years	...	35,69,902

Against this total deficit of R35,69,902, Travancore had only R5,65,406 as surplus distributed over the last two years thus:—

1908	—	56,910
1909	—	5,08,496
		R5,65,406

The surplus came mainly from the new settlement rates, and the maximum limit of taxation from land has thus been reached; the settlement operations have almost been concluded in the State. Such being the state of affairs, there is no appreciable source of revenue which the Government could legitimately and conveniently stop. The annual revenue from tobacco alone is, on an average, about R12 lakhs which income is sure to be considerably reduced, if not made to disappear from the Account Books, in case the new tax on tobacco is to be continued. The Department under the Excise Commissioner has last year, as annual revenue, Rs.46,67,274 distributed over the following items:—

			Rs.
1.	Customs	... ...	13,35,552
2.	Tobacco	... ...	12,98,549
3.	Salt ...	... ...	10,08,854
4.	Abkari ...	... ...	9,70,403
5.	Opium and Bhang	...	53,916
		Total ...	46,67,274

From the above it will be seen that tobacco figures largely in the receipts of the Department, whose income is about half of the revenue of the State. It is, therefore, a serious matter for the consideration both of this Durbar and of the British Government. Mr. Rajagopalachari has already addressed the Madras Government on the subject, and it remains to be seen as to how the problem will be solved. In the meanwhile the merchants have also made up their mind to approach the British Indian Government in the matter.

No reply—we learn on enquiry of the Acting Colonial Secretary—has yet been received from either Travancore or Madras to the representations made by the Ceylon Government *re* the increased duty on tobacco and the consequent ruination of the Jaffna industry in that product. The Government of India imposed the duty with a view to making up for an expected loss in Opium revenue, and the difficulty is thought to be that it cannot help Ceylon without giving it preferential treatment. It is, therefore, unlikely that Ceylon will be benefited, unless, as we understand is the case, the Indian Government finds that it is only killing the goose which lays the golden eggs by stifling the trade altogether, and thus obtaining no revenue at all. In the event of this happening it may decide to take off the duty generally, and the Northerners of this island will be once again in their old position. Otherwise there seems to our authorities nothing for it but for the men of Jaffna to seek to gain a living by the pursuit of some other industry!

CACAO PRODUCTION IN ECUADOR IN 1909.

The "Nachrichten für Handel und Industrie" (Berlin) of March 4th, quoting from a report by the German Consulate at Guayaquil, states that the total production of cacao in Ecuador in 1909 was 62,065,716 lb, as compared with 63,196,125 lb in the previous year, a decrease of about 1·8 per cent.—*Board of Trade Journal*, March 31.

F.M.S. PLANTERS' CONFERENCE ON RUBBER.

Mr. W J Gallagher, Director ot Agriculture, was voted to the chair at the Planters' Conference in the Masonic Hall on Sunday morning, which was attended by about 40, including leading planters in the Federated Malay States.

TAPPABLE GIRTH.

The CHAIRMAN—was about to open the discussion on the first item on the agenda, the girth at which to commence tapping, when Mr A B LAKE proposed that the press be excluded from the meeting. Mr C E S BAXENDALE objected, saying he thought the representative of the press should be allowed to remain. The matter having been put to the vote, it was decided, by a majority of one, not to exclude the press, and the discussion was resumed.

The CHAIRMAN—said that most of the written replies he had received favoured a girth of 18 inches, at three feet from the ground, as the best time to begin tapping.

Mr. BAXENDALE—said that, from his own experience, 18 inches was a fair girth to start at. If 65 per cent of the trees in an area were tappable at 18 inches, it would probably be worth tapping them; but it would depend on the age of the trees. He did not think that tapping increased the growth of trees, on the contrary he thought that the growth of the tree was retarded while tapping was in progress.

Mr DUNCAN—thought the girth at which tapping could be begun should be determined more by the possibility of tapping well than by any particular size. Personally he should not like to start tapping trees of small girth but, having 80 per cent of trees of that girth, he would not mind tapping down to 16 inches. He did not think the quality of rubber from young and old trees differed very much. If a tree was big enough to be tapped without any danger, it should be tapped.

The CHAIRMAN—said the general opinion seemed to be that age should not be considered but girth alone and 18 inches at a height of 3 feet from the ground was generally favoured.

Mr E V CAREY—asked if anybody could say whether small trees were injured by tapping.

The CHAIRMAN—said only two answers had been received under this head: one said it increased growth, the other that no harm resulted if the methods were good.

Mr M CUMMING—said that he had known trees badly tapped which had had their growth retarded for several years.

The CHAIRMAN—said he thought the meeting was in favour of tapping at 18 inches girth three feet from the ground and that it agreed that if a tree were tapped well there was no deleterious effect.

TAPPING SYSTEMS.

The next pont discussed was the best system of tapping. In the written answers sent in the Chairman said five correspondents preferred tapping two opposte quarters, one suggosted one quarter in one year and another said, for convenience of working, he preferrod two adjacent quarters, though, apart from convenience, he would prefer two opposite quarters.

Mr F G HARVEY—thought that opposite quarters was the best system but the objection was that two oups were required.

Mr W H TROTTER—said the only plan he knew was to take one line up and come down the next line and use one cup in the morning and the same cup in the evening on the other side.

Mr CUMMING—said there was one point on which people were pretty well satisfied and that was that, on tapping renewed bark, the bark was got through more quickly than the first time.

The CHAIRMAN—said he should have some figures available in the near future on influence of distance between the cuts, as he thought the question was an important one. He then traced a diagram on the blackboard to show that the further apart the cuts were made, the less distance the material to renew the cut away bark had to move in a transverse direction—its course more nearly approached a line parallel to the axis of the tree. Turning to the question of

WHICH PERIOD OF THE DAY WAS BEST FOR TAPPING,

the Chairman said the answers he had received varied from 5 to 10 a.m. and 6.30 to 9.30 a.m. After some remarks from those present he said that it was, like other questions, a subject of compromise. Planters might know what was the ideal, but they had to fit it in with special circumstances in which they found themselves.

On the question of whether it was

BEST TO TAP EVERY DAY OR EVERY OTHER DAY,

Mr. A J CAMPBELL, Superintendent of Experimental Plantations, said that, as the result of experiments which he had carried out over a period of six months, he found that, in the first three months, tapping on alternate days gave slightly the best results, but during the second three months, tapping every day gave the bigger yield.

Mr. CUMMING—said he experimented with daily tapping for six months and had to return to tapping every other day.

Mr. A. J FOX—stated that has experience was against daily tapping.

Mr. C BURN-MURDOCH—said he found daily tapping yielded very little more latex than tapping on alternate days.

Mr. A. B. LAKE—thought the result of the experiments would depend on the character of the land.

Some discussion ensued as to the amount of labour required by the two systems, in the course of which the CHAIRMAN said that the number of cuts—the amount of bark removed—at the end of two days was the same under both systems but the coolie walked twice the distance and used twice as many cups in every-day tapping as in tapping on alternate days. In conclusion he said that he thought a majority favoured tapping on alternate days, but he reminded his audience that there were two ways of looking at this as at other problems; the best way, and the most practicable way under the particular conditions to be faced.

VARIATIONS IN YIELD.

In opening the discussion on "variations in yield" the CHAIRMAN drew on the blackboard a sketch of a chart shewing the monthly variations in yield.

Mr Baxendale—then said :—"Before venturing to address an audience, which includes so many planters who have had the advantage of a more varied experience than my own, I would like to make it clear that with one exception my remarks only apply to a very limited area in one of the Coast districts. The conditions, soil, rainfall, etc., are so different in the hill country and the lowlands, that I shall be filled with a glad surprise if my experiences have been generally shared by those whose interests are confined to an Ulu district. I must at any rate go to the hill country for the highest yield I have ever known. This was from one of the trees imported by the late Sir Hugh Low, and it is growing on Gapis Estate, Perak. In fifteen days, from July 17th-July 31st, 1902, I collected 6½ lb of rubber from three small cuts close to the base. After I left Gapis, Mr Salisbury continued the tapping spasmodically, and the total result of our labour, in 35 days actual tapping (between July 17th and Sept. 18th) was 18 lb. of rubber dried in lumps. The tree was 25 years old and measured 89 inches in girth, at one yard from the ground. At the risk of depreciating shares in Coast district Estates I must regretfully turn to my own country-side and submit nine pounds an acre a month as the average for the first three months' tapping of four year old trees, as the lowest yield I have experienced. While it may be asserted that a large and well distributed rainfall is essential, the benefit is not always immediately apparent. For instance, I found the yield per coolie in the wettest month last year considerably below the average. The fact that the tasks were completed later in the day no doubt had a good deal to do with this, but when the trees become very wet the latex washes over the cuts and spreads itself in such a fine layer down the bark that it is most difficult to collect even in scrap form. I do not find that this has any adverse effect on the yield. Both this year and last year our highest yields, not only by the coolie but by acre as well, were in February and March when the wintering was general. A certain botanical authority, who from time to time writes to financial papers advising that no more than 40 trees should be planted to the acre, evidently fails to take into consideration the damage done to such brittle trees, by wind, white ants and fungus. The fewer trees, the greater the percentage of loss; but even if all survive, I question if you would be getting the best results from your land by such wide planting. Basing my results from avenue trees (8 lb. each at 8 years old), I find that if the trees in the old fields had been planted 40' × 40' instead of 15' × 15', we should be harvesting considerably less rubber than we do at present. I know that 15' × 15' is now generally considered too close; but, at any rate, it allows of a good selection being made when thinning out becomes necessary. The best result I can quote from any field in the Coast districts came from one originally planted with 312 trees to the acre, and gradually reduced to 140—at ten years old. While I believe in the advantage of regular and systematic tapping, I have on more than one occasion seen striking evidence that the Para tree accumulates reserves of latex. Of course, I am aware that many people hold the same theory on this subject that others hold about women, dogs and walnut trees—'The more you beat (or tap) 'em the better they be,' and anything I may say which savours to the contrary may be regarded almost heresy by some present. I do not mean to say, that if the 25-years-old tree I tapped for the first time in 1902 had been tapped twenty years earlier it would not have yielded far more rubber in the course of its natural life—and I am also prepared to allow that it would have been more profitable to its owners, unless its output had flooded the market for pencil eraser which was its most important purpose in those days—but I think I am justified in entertaining doubts of the yield being maintained at the rate of half-a-pound a day, until someone tells me he has collected 180 lb. of rubber from any tree in a year. It is the same story with young trees. I never now see the brimming cups of latex that used to gladden my heart in bygone days when we tapped our trees vigorously for three months of the year and rested them for nine. But now, though the tree yields less per day, it yields more in the year and it pays to tap every day (or alternate day) if the price of rubber was even less than 12s a lb. There is, however, this to be said for 'resting.' If your estate happened to be—unlike any of those floated in the last few years—short of labour,—you would have the consolation of knowing that you could get back some of the arrears and at less cost of collection—provided the shortage was not great enough to make the 'rest' too long."

Mr. Trotter and Mr. Lake—said they found that the response of rubber to rain was felt the second day following that on which the rain fell.

Mr P W Parkinson—said his experience was that the yield was higher in wet than in dry weather.

Mr Duncan—said that trees responded very quickly to rain in flat land.

Mr E V Carey—said that, on the whole, he found the yield better in wet than dry weather.

Mr Trotter—then described the case of two neighbouring estates one of which, in March, 1909, was yielding at a much higher rate from young trees than the other from old trees, while in March of this year the opposite was the case; the estate whose trees were yielding so much in 1909 was not doing as well, while the estate with the older trees was yieldiug excellently.

Mr Dupuis Brown—thought seeding affected the yield. The decrease in the published figures of February outputs from estates this year was very marked.

It was pointed out by some of those present that February was a short month, that it included a Tamil holiday, and that these two factors necessarily made for a decreased output.

Mr R W Harrison—thought that hill ground maintained yield better in drought than rubber planted in flat land.

Bark Renewal.

On the question of bark renewal, the next item on the agenda, Mr Cumming said that regarding distance of planting, which was a factor, a great deal depended on the configuration of the land, Closer planting was possible

on hill land than on flat because the light had more chance to get among trees on the slopes of hills than on level ground. He thought that, from his observations, close planting would, during the first few years, give more rubber than wide planting.

Mr. PARKINSON—said he considered two years was an ample allowance for bark renewal on the first tapping but afterwards three years was required.

The CHAIRMAN—said a similar view had been sent in by one planter.

Mr. CUMMING—said there were a great many estates the trees on which might be tapped after six months for bark renewal. As the Chairman had said it all depended on the depth of the cut.

The CHAIRMAN—said that the general opinion seemed to be that three years was the right time to allow for bark renewal though it was his impression that most estates were worked on a four year system. It was not a question only of what a tree would bear, it had to be considered what thickness was best to give an economic return.

NUMBER OF CUTS.

On the question of the number of cuts to the inch the CHAIRMAN—said he had received written answers giving 10, 16 to 20, 22 and 25 cuts.

Mr. LAKE—said he favoured 25 and Mr H T Fraser thought 30 was a possible number.

The CHAIRMAN—considered that 20 cuts per inch ought to be obtained, that 22 was a good average. He thought anything over 25 would be exceptional.

Mr CUMMING—said a lot depended on how old the trees were when tapping was started. In tapping ten-year-old trees never tapped before it was not possible to get more than 10 to 12 cuts to the inch.

Mr PARKINSON—agreed, and added it was not possible to get so many cuts on renewed bark as on trees newly tapped.

The CHAIRMAN—said it seemed that a good average was 20 to 25 cuts. His experience was that it was possible to get more latex with 20 or 22 cuts than with 10 or 15. Some Ceylon planters, with whom he had lately spoken, had assured him that in Ceylon it was no use trying to get more than 15.

Turning to the next item, the best kind of knives, cups and instruments generally, the Chairman said the written answers favoured the improved farriers' and the gouge except one, the writer of which preferred the Sculfer knife.

Mr PARKINSON—said more depended on

"THE MAN BEHIND THE KNIFE"

than on the knife itself.

On the subject of latex cups the Chairman said he had had answers from eight people ; five were in favour of glass, and three of earthenware, while three of the answers added that no metal cups should be used.

Mr. CUMMING—said he had experimented with aluminium cups. They were expensive, but at the end of six months they were just as good as ever. They were also easily cleaned and light to handle.

Mr. PARKINSON—had found porcelain satisfactory. It cost a good deal more than tin, but it was clean and had a longer life. His coolies took round a latex bucket and a water bucket, washed the cup on the spot and hung it up. Latex came well out of a porcelain cup.

Mr. DUNCAN—said he employed the same method. He had found glass cups very satisfactory as they were easy to clean. A good many, however, arrived broken.

Mr. PARKINSON—said the percentage of porcelain cups broken in transit was very small.

The CHAIRMAN—said he thought there was a general agreement that tin cups were not so good as cups made of aluminium, glazed earthenware or porcelain. He added that he supposed most people were agreed that all other vessels should be of the best quality of enamelled iron, as cheap qualities chipped too soon.

In some remarks on spouts, it was mentioned that aluminium v-shaped spouts had been used.

COLLECTION OF LATEX.

Discussing the collection of latex, Mr Duncan said he had the latex put straight into enamelled tins, acetic acid was added, and the tins were then placed on trucks and taken straight to the factory, the shaking in transit assisting coagulation.

The CHAIRMAN—said that the main question was whether it was best to coagulate the latex in the field or at the factory.

Mr. CUMMING—said that when latex had to be brought a long way to be coagulated it was not so good as if it was coagulated on the spot.

After some further discussion the CHAIRMAN said it seemed that there was an agreement that the quicker latex could be coagulated, the better. It seemed to him that the meeting favoured coagulating in the field.

Mr FOX—then said that he had been running a smoking machine for the last ten days as an experiment. At first it had turned out rubber of a variety of colours but latterly the colour had been more even and the process seemed, so far, to be a good one.

The CHAIRMAN—thought smoking was the system of the future and added it would be interesting to see what price the rubber produced by Mr Fox's machine fetched.

THE COOLIE'S TASK.

The next subject was the coolie's task.

The CHAIRMAN—said it was difficult to fix the task. His written answers gave from 800 to 1,500 cuts per day and 250, 275, 300 and 310 trees.

Mr FOX—said he found his coolies averaged 1,600 cuts. The coolies tapped and collected the rubber but did not "scrap."

Mr PARKINSON—said the task must vary with the age of the tree. He found an average of 150 trees with 8 cuts each making a total of 1,200 cuts, the cooly collecting the latex and bark, washing the cups and carrying the latex to the coagulating sheds. With older trees he found an average of 120 trees with 8 cuts each. The "scrapping" was done by women and children. When doing 150 trees the coolie did 75 in the morning, stopped, collected the latex ; then another 75, finishing from 2 to 2-30 p.m.

In the course of some further discussion the CHAIRMAN said on one estate the tapper did nothing but actually cut the trees. He did not even place the cups.

Mr DUNCAN said the difficulty of such a system would be that another coolie would always have to be ready to place the cup at exactly the right moment.

On the question of the control of tapping coolies, which figured next on the agenda, Mr. Burn Murdoch said :—

"I feel very diffident about opening the discussion on this question as I have seen few estates beyond my own circle and have no information of their methods of control. The question asked—is the control of the individual or the group the best and how ? I say unhesitatingly 'of the group.' The whole matter in my mind is very closely identified with heading No 11 on the agenda 'Style of book for keeping returns,' for this reason, that the daily return, if kept for separate sections, enables a very close supervision to be kept on any particular group or section. For instance, if section I, under normal conditions, gives 100 lb and a look at the list shows it has fallen off to 70 lb, that particular section can be at once visited and the reason of this falling oft almost certainly found out. This would apply also if the same section suddenly rose in yield. Unless estates are grouped or divided up into tapping sections, I cannot see how really efficient control can be kept. This system of course entails a lot of clerical work but I do not think it is in any way wasted. In fact I would go further and say I do not see how a large area could be otherwise efficiently controlled. The size of the sections of course depends on the lay of the land, but I would not recommend sections of more than about 6,000 trees. A good coolie or sub-kangani can be put in charge of this. I do not think there can be anything said in favour of individual control. It is impossible that there can be Europeans enough to watch all the individuals. The European of course generally supervises the work and gets at the individual through his section kangany. I do not think I need say any more in opening the discussion under this heading.'

Mr PARKINSON—said he agreed that the system was best on a large estate. On his estate they worked by fields of 20 acres or more. If there was a falling off on any particular field it was possible to find out by the returns sent in to the office, and go and visit it.

In answer to a question asked by the CHAIRMAN, Mr BURN MURDOCH—said about 30 men could be coveniently controlled in a group under his system.

PERCENTAGE OF GRADES.

The last subject which was brought before the meeting was the percentage of different grades.

Mr BURN MURDOCH—gave 75 per cent of No 1 as the results of his observations. Mr BAXENDALE thought 60 per cent represented the averrage of the low country in a dry season.

In the further course of the discussion Mr H T Fraser read the following figures relating to a series of experiments lasting over six months :—

YOUNG RUBBER.

	First three.	After six.
No. I	85	83
Lump	1	3
Scrap	10	10
Shavings	4	4
	100%	100%

In concluding the CHAIRMAN—remarked that he thought 70 was a good number, and he added the caution that, in order to ensure purity, the water in the cup should be as clean as possible, as all the little hardly visible impurities in the water were centres of coagulation in the cup. Finally he said that he was sorry to say that the books he had hoped to have showing the style of book useful for preparing rubber returns were not ready, nor were the plans of a drying house yet available.

An enthusiastic vote of thanks to Mr Gallagher for taking the chair with such conspicuous success brought the meeting to a close. —*Malay Mail*, May 3.

THE AVAILABILITY OF SULPHATE OF AMMONIA.

The common belief is that sulphate of ammonia when applied as a manure must first be converted into nitrites and then into nitrates by the action of nitrifying germs, but it is now known that it can, to some extent, be directly absorbed. The result of recent investigation by Hutchinson and Miller of Rothamstead has gone to show :—(1) That ammonium sulphate is absorbed directly by wheat and peas ; (2) that under the conditions of the experiment peas thrive equally well whether they are supplied with ammonia salts or nitrates ; (3) that wheat grows best with nitrates ; (4) that the growth of young plants may be stimulated by freshly applied ammonium sulphato ; (5) that unless the land is very poor there is little need for an interval between application of the manure and growing the crop as the manure is immediately available to a certain extent ; (6) that where plants are required to take up a large quantity of nitrogen it is likely that both ammonium sulphate together with nitrates will prove more beneficial.

CEARA SEED AND ANTS.

If Ceara seeds which have been filed do not germinate in the nursery quickly, they are apt to be attacked by ants, which gain an entrance through the filed orifice and eat out the whole of the kernels. A planter, who has been troubled in this way, informs me that he can keep the ants away from his beds of seeds until the Ceara seeds germinate by putting fresh coconuts round them. He breaks coconuts in half and puts down four to six of these halves at intervals round each seed bed. The ants devote all their attention to feeding on these coconuts and leave the Ceara seed alone. The ants can be killed from time to time, if desired, by pouring boiling water on the coconuts covered with them. My informant protects his vegetable-seeds, such as lettuce, onions, &c, of which ants are very fond, in the same simple way.—RUDOLPH D. ANSTEAD. Planting Expert.—*Planters' Chronicle*. May 7.

COCA CULTIVATION IN PERU.

The bulk of the coca leaves of commorce are obtained from Peru, with smaller amounts from Bolivia, Java and Ceylon. In recent years, owing to the increasing use of the drug, either as such, or in the form of cocaine, the demand of coca leaves in Peru has been so great that the natural forests of coca bushes are beginning to show signs of exhaustion, and attention is now being given to the cultivation of the plant (*Der Tropenflanzer*, 1909, 10. 386). It grows in Peru at an elevation of from 700 to 2,500 metres above sea level, and requires a deep, fairly rich soil. In forming a plantation the existing crop on the land is cut and the débris from this piled in heaps and burnt, the heat from the burning refuse serving to destroy insect pests in the soil. The plants are best raised from seeds sown in nurseries. Coca seed keeps badly, and it is advisable to use seed not more than eight days old for sowing. The seed bed should consist of good, well-worked soil, and the seeds should not be deeply buried, but merely lightly covered with a thin layer of soil. They should germinate in about a fortnight, and should reach a height of from 8 to 12 inches in about four or five months, when they are ready for transplanting. The soil in the proposed plantation should be well worked to a depth of about one foot, and the seedlings planted out at distances of about 40 inches from each other, *i. e.* 40 inches square should be allowed to each plant. The plantation requires little care except occasional weeding, but young plants in the nursery or the plantation require shading from strong sunshine and protection from frost on cold nights. Leaf collection should not begin till the plants are two years old, but to secure a return in the first two years, maize or manioc (cassava) may be taken as a catch crop between the rows of coca plants. In collecting the leaves, these should be roughly torn from the branches, but should not be broken off, or cut a little above the connection of the leaf petiole with the branch. A well-grown plant should yield annually from 5 to 10 lb. of leaves, and should continue to yield for from ten to twenty years, provided it is grown in good soil and a suitable situation. The leaves should be slowly dried in a shady place, frequent turning being resorted to, to prevent sweating.

The present value of Peruvian coca leaves is about 5½d. to 6d. per lb., but the carefully grown and prepared Ceylon leaves fetch as much as 10d to 1s. per lb., or more, at the present time. Since the natural supply of Peruvian leaves is failing to some extent, there would appear to be

AN OPENING FOR THE MODERATE EXTENSION OF COCA-PLANTING IN CEYLON

and the Federated Malay States, where the plant has been found to do well already. In forming plantations care should be taken to secure seed of the Peruvian variety, the leaves of which contain cocaine, and not that grown in Java, which furnishes leaves containing little or no cocaine, but only closely related alkaloids, which have to be converted into cocaine by a chemical process after extraction. The Java leaves, it should be noted, however, are richer in "total alkaloid" than the Peruvian sort.—*Imperial Institute Bulletin*, Vol. VIII, No. 1.

RUBBER IN COCHIN AND TRAVANCORE.

[BY THE U. P. A. S. I SCIENTIFIC OFFICER.]

CULTIVATION.—My views upon the system of keeping rubber clean weeded have been expressed elsewhere. On many estates cultivated under this system the annual loss of top soil is enormous, and it will doubtless seriously affect the life of the rubber. The rainfall on a typical estate, for instance, during last year was in May 15·5 inches, in June 33 inches, and in July 33·6 inches. This heavy rain fell on bare soil which had been powdered all through the dry season by constant mamotie weeding, and the consequence was that tons and tons of the very best top soil were washed away and laid over the surface of surrounding paddy fields. The loss and the evil are usually admitted, and in some cases curious, and often expensive and cumbersome, methods of mounds and trenches, &c., are adopted to try and stop the wash. The simplest method of all is to grow a green dressing instead of weeds, and keep the soil covered. This will not only stop the wash during the monsoon, but it will add humus to the soil both from its own material and by catching and holding the fallen rubber leaves, which on many clean weeded wind-swept estates are blown away and lost, and all the dry season it will keep the soil shaded and moist, bringing the soil water near the surface where it is wanted.

A DIRECT EXPERIMENT—showed on one estate I visited that the soil under a covering of *Passiflora* contained in February, after three months of dry hot weather, 11 per cent. more moisture than the soil which had been kept bare and clean weeded. The preservation of the top soil and the constant addition of humus to it to improve the mechanical condition are most important points, and I am sure that no rubber plantor can afford to neglect them. In some districts a thick cover of *Erythrina* is grown, the branches being bent over so that the whole soil is shaded, and covered with a thick layer of mulch, while open spots are covered with a crop of *Passiflora* or *Crotalaria.* Such estates are quite as good as, in fact in one or two notable instances much better than, estates which have always been clean weeded. *Erythrina* will not grow in all districts, possibly because the necessary soil bacteria are not present. If the soil in the holes in which the plants are started was inoculated with a little soil brought from an estate where *Erythrina* is well established probably the difficulty would be overcome. This, however, is hardly a practical method, though it would form an interesting experiment. In districts where *Erythrina* will not grow, Albizzias should be tried, and cut over in the same way as *Erythrina*, and more use should be made throughout the whole of the rubber districts of local leguminous plants like the various indigenous *Crotalarias*, *Cassia hirsuta*, *Cassia mimosoides*, *Tephrosia tinctoria*, *Tephrosia purpurea*, &c.

The starting-point for such green dressings is a clean weeded estate. In a new clearing the weeds should be got rid of as soon as possible by rounds of weeding following one another in quick succession so that the indigenous crop of

weeds is allowed to seed as little as possible. This is the time to spend money lavishly upon weeding. As soon as the weeds have been got fairly well in hand, which should be at the end of 18 months at most, the whole place should be covered with Passiflora, which should be planted out from nurseries in beds down the rows, and *cultivated*, and hand-weeded till established. This will choke out the last of the weeds, and it can then be replaced by a suitable légume. Estates treated this way will have a longer future before them, and will I am convinced, reach a tappable size just as rapidly as places which are kept clean weeded. When it comes to tapping, the yield of latex will be greater from trees grown with a green dressing, because there will be more soil moisture in contact with the roots.

MANURING.—Suitable manures for rubber have still to be worked out, and only direct experiment in the field can determine what will be the best mixture. An analysis of the typical soil on each estate should be made, showing its mechanical condition, and the amount of plant food available in it. This will indicate the kind of fertiliser which will be most suitable, and with this as a working basis experiments varying the amounts of the ingredients and times of application must be made. In the absence of chemical analyses of the soil a complete fertiliser containing 7 per cent of Nitrogen, 8 per cent of available phosphoric acid, and 8 percent of Potash, will probably be found about right. This should be supplied at the rate of 3 lb. per tree, in two applications of 1½ lb. each, in September and March.

MANUFACTURE.—My attention was called to discoloured biscuits, which are sometimes obtained. These dry black and are in several ways unsatisfactory. To assign the exact reason for this would, of course, need careful laboratory study, but I think that the remedy lies in paying more attention to cleanliness of the collecting cups, and the use of disinfectants in the factory. Coagulating dishes, &c., should be kept scrupulously clean, and free from bacteria. When dark coloured biscuits are obtained I advise a general clean up, especially of the collecting cups, and I think that it will be found that this will remove the evil. The question of the most suitable material for collecting cups is one which has not been solved to general satisfaction. Glass is, in my opinion, the best as it is so easily kept clean. In Mundakayam, however, a great deal is to be said for coconut shells, which are very easily and cheaply obtainable locally and in practice can be easily washed free of latex and kept clean. Each shell when out of use is hung on the top of a stick stuck in the ground against the tree to keep it from being splashed with mud when rain falls.

Many estates which have begun to tap are preparing to erect factories, and in this connection I should like to call attention to the fact that each year as the trees grow older there will be a steadily increasing crop of seed.

The demand for Hevea seed for planting purposes will soon be at an end, but there seems to be an excellent prospect of using it as an oil seed. This is a by-product of the rubber industry which will repay attention, and it should add considerably to the profits, especially when the price of rubber falls, as I suppose it must do in future years.

Hence in building factories and putting down machinery provision should be made in the plans, and in the horse-power of the engines, for the possible future addition of crushing plant, since the best plan of handling the seed will probably be to crush it on the estate, extract and ship the oil, and return the cake, as Pará poonac, to the soil as a fertiliser. I foresee that in the future there are great possibilities in this direction.—RUDOLPH, D. ANSTEAD, *Planting Expert.—Planters' Chronicle*, May 7.

RUBBERS FROM SIERRA LEONE.

The rubber-yielding plants indigenous in Sierra Leone include *Funtumia elastica*, Stapf, the West African rubber tree, and species of Landolphia vines. A number of samples of rubber from both these sources have been forwarded to the Imperial Institute from the Colony, and the results of examination [of the best] is given in the following :—

"Funtumia rubber. Prepared by diluting one part of the latex with 10 parts of water and boiling." Weight, 2¼ lb.

The specimen consisted of thin irregular biscuits, which were very moist and mouldy on the surface when received. Before analysis and valuation, the mould was removed and the surface moisture driven off by exposure to a gentle heat. The biscuits were dark coloured, clean, rather rough on the surface, and had a smoky odour. The physical properties of the rubber were very satisfactory. An analysis gave the following results :—

	Rubber after partial drying. Per cent.	Composition of dry rubber. Per cent.
Moisture ..	9·4	—
Caoutchouc ..	81·9	90·5
Resin ..	5·7	6·3
Proteids ..	1·8	1·9
Insoluble matter ..	1·2	1·3
Ash ..	0·27	0 29

The rubber was described by brokers as "fairly clean rough biscuits ; strong, well prepared and in good condition," and was valued at 4s to 4s 3d per lb. in London, with fine hard Para quoted at 4s 7d per lb.

This rubber is of good quality, containing over 90 per cent. of caoutchouc in the dry material, whilst the amounts of resin, proteid and insoluble matter are all low. The sample as received contained an excessive quantity of moisture, and in consequence there had been a considerable development of mould on the surface of the biscuits during transit. It was stated, however, that the sample had not been dried thoroughly before despatch, as would be done in the case of rubber prepared for sale. The price quoted for the biscuits after partial drying here was very satisfactory.—*Imperial Institute Bulletin*, Vol. VIII., No. 1 of 1910.

NICARAGUAN CRIOLLO CACAO.

MR. J. H. HART'S CRITICISMS OF MESSRS. R. H. LOCK'S AND HERBERT WRIGHT'S BOOKS.

From the proceedings of the Agricultural Society of Trinidad and Tobago we note that a somewhat heated discussion has been waged by agricultural scientists in that island regarding the identification of certain varieties of cacao. The names of more than one scientific gentleman connected with Ceylon are mentioned, and we are, therefore, induced to give a brief outline of the correspondence which covers eight pages of the journal referred to. It appears that at an Agricultural Show held in Port-of-Spain some time ago, the Department of Agriculture exhibited a set of cacao pods amongst which was a lot labelled *Nicaraguan Criotto.* These pods according to Mr. J. H. Hart, F. L. S., were so contrary to the form recognised as *Nicaraguan Criotto* as figured by Preuss, Wright, and several others that it would appear important to ascertain their origin, and he suggested that the Department of Agriculture might be asked to afford information on the point. The pods in question had yellow skin, bottle necks, and generally showed all the points of Trinidad Criollo. Our old friend, Mr. J. B. Carruthers, subsequently wrote to the Secretary of the Agricultural Society regretting that Mr. Hart considered the designation on the labels of some of the cacao exhibited at the Show incorrect; and pointed out that the question of the characters of the varieties of Theobroma afforded much scope for difference of opinion and those who had paid special attention to the matter had varied views. Classifications had been made by Hart, Morris, Preuss, Wright and Lock, and he had discussed the subject with the last three botanists. All their lists applied to some extent to varieties as found in all countries where cacao was cultivated. In regard to Morris' and Hart's classifications, Mr. Carruthers said Dr. Preuss was of the opinion that they did not always strictly apply to cacao even in Trinidad itsolf. The most recent and authoritative classification was that of Mr. R. H. Lock, late fellow of Caius Cambridge and Assistant Director of Gardens, Ceylon, who was an authority on variation and heredity in plants. His paper in the Annals of the Royal Botanic Gardens, Peradeniya, with coloured plates was most exhaustive. Unfortunately there was no copy in the library there and his own copy was in the hands of the binder in England, so that he could not compare the pods which were exhibited at the Show with Mr. Lock's system. Proceeding Mr. Carruthers pointed out that new strains arise in cacao with great facility, and in Trinidad as elsewhere the pods borne by a tree at one crop do not always agree in their external characters, size, shape, colour, etc., with the fruits of the same tree at another time. This resulted in much confusion and made the task of compiling a satisfactory and permanent catalogue of cacao fruits possessing distinctive characters more than difficult. The fact that the varieties are so little constant makes them of less importance agriculturally, and for some years he declared he had advocated that in amelioration of cacao cultivation, selection for bearing yields and not for varietal characters was the best mode of progress. He had no doubt that, as Mr. Hart pointed out, the pods he saw at the Agricultural Show were not what he recognised as typical "Nicaraguan Criollo" and perhaps not even what he would call "Nicaraguan Criollo" at all, but as there was no accepted standard it was not possible to label pods so that all experts in this question would be satisfied. Mr. Hart makes a vigorous and lengthy reply alleging that the question referred to the Department of Agriculture, had not been answered, but a disquisition on value of varieties of cacao, and an estimation of the work of various writers on the subject, had been substituted. The question asked was plain; viz. "*It would appear important to ascertain their origin, and I suggest that the Department of Agriculture be asked to afford information on the point.*" He also asked it to be further noted that the "Government Botanist has altered the subject of the minute paper, and had substituted another for discussion." He then proceeds to criticise the works of both Mr. R. H. Lock and Mr. Herbert Wright. Mr. Hart is, of course, an authority on the subject and we give his remarks in full:—

Mr. Carruthers refers to Mr. Lock (a gentleman of short tropical experience) as having given the most recent and authoritative classification of cacao. A reference to that gentleman's work however will show that he was almost entirely dealing with material sent to the East from the West Indies; the larger part of which Messrs. Lock and Carruthers should be unaware *was selected and forwarded by the writer* to the late Dr. Trimen when in charge of the Ceylon Gardens, and since. It should follow therefore, that I may rightly claim some authority in my own determinations; especially seeing that my experience extends to more than twice that of the gentlemen mentioned. Lock's classification is given in Wright's Work (page 30) which I have in hand and differs little from those of Hart and Morris. But although Lock's classification may be authoritative for Ceylon, where they have assembled some of the West Indian and Central American varieties, it does not necessarily follow that it covers all the cacao of the western world. The Government Botanist discusses and depreciates the value of classifications but appears to have overlooked the important fact in relation to the question now at issue, (viz): that Lock has actually given a most *distinctive character* for Nicaraguan Criollo while he asserts that *there is no accepted standard.* His contention is unfortunate, for if there is one variety in the whole range of cacao, which can be defined by its characters it is the Nicaraguan Criollo, and it is to be noted that Preuss, Wright, Lock and Hart, all agree upon this point. *Nicaraguan Cacao* has a high shouldered pod either red or yellow and has seeds nearly double tho size of any other variety of Theobroma Cacao, a fine break,

flavour and colour of the most admired type. *Trinidad Criollo* has a bottle-necked pod, either red or yellow, with small roundish light coloured seeds, not half the size of the Nicaraguan. Lock—unfortunately perhaps,—does not appear to have seen or recorded a bottle-necked *Criollo* form and there is no figure of it among Wright's Illustrations of Ceylon-grown Cacao. In fact it has not been sent there. I found the Nicaraguan Criollo in Central America in 1886, and I again found it in Nicaragua in 1893. I collected it, with three other distinct species of Cacao not hitherto well known, and introduced it to Trinidad, whence I distributed plants to Ceylon a year later. These plants are the parents which produced the fruit of Nicaraguan Criollo figured by Wright at p. 28 of his work, and exactly correspond with figures and drawings by Preuss, who shows the bean at p. 166, Fig. I, and the pod in Plate I, Fig. II, as he saw them in Nicaragua. Wright mentions that Preuss "*states that Criollo is neither native or wild* in Trinidad, but has been introduced there." This gives an erroneous impression, as Preuss was referring to the Venezuelan Criollo (see page 40 of Wright's work.) He did not find the Trinidad form in his 14 days stay here; personally I did not find it until after nearly as many years search. The pods exhibited by the Department of Agriculture cannot claim close affinity with Nicaraguan; but have all the characters of Trinidad Criollo. The statement that there is "no accepted standard" cannot be sustained, for more than one reason, as this Cacao has recently been valued on account of its unique character at nearly double the value of Trinidad Cacao. It is not now grown exclusively in Nicaragua, but still appears plentifully in the neighbourhood of Rivas on the estates of Monsieur Menier and others. Certain minor differences in form no doubt occur, as Mr. Carruthers says, in pods upon the same tree. But it is yet to be recorded that the bottle-necked form of pod changes to a high-shouldered form, or that the large bean of the Nicaraguan ever changes to the small one of the Trinidad Criollo and *vice versa*. The classifications of Hart and Morris are said by Wright to be applicable to Ceylon, on account of the fact he mentions (viz.,) "that most of our seed supplies have been obtained from Trinidad."—(Wright, p. 29). It is on this page I find the sentence adopted by Mr. Carruthers, in which Wright quotes Preuss, as stating that the classes of Hart and Morris "*do not strictly apply even in Trinidad itself.*" This statement, it may be noted, came from a gentleman who was able to make only a hurried examination of the countries he visited, but whose experience is far from equal to that of the writers he discusses, from one of whom he sought his Trinidad information. The fact is, I introduced a valuable variety of Cacao from Nicaragua, I know it well and its points, and I cannot accept the nomenclature adopted by the Department of Agriculture as representing Nicaraguan Criollo, when I know it to be something altogether different, well distinct, and more valuable than that exhibited by the Department. And I again venture to ask that the Department be good enough to furnish for the information of the Society the source or origin of the pods in question.

PLANTATION RUBBER.

MR. J. PARKIN'S VIEWS.

Mr John Parkin, M.A., F.L.S., writes in the course of an interesting article on "The Science and Practice of Para Rubber Cultivation," which is published in the April issue of *Science Progress*, as follows :—

THE QUALITY OF PLANTATION RUBBER.

The rivalry which is now commencing between plantation Para rubber and the wild product of Brazil will be keenly felt in the near future. The latter has been the Standard caoutchouc for a long period, and buyers can rely on its uniform, excellent qualities. Manufacturers have their machinery especially adapted for its manipulation. Its requirements as regards vulcanisation are known exactly. It is the specified brand to be employed in a number of Government and other contracts. Little wonder then that plantation rubber should have met with some little opposition at the outset. The surprise rather is that it has come to the front so quickly. This early success is largely no doubt to be attributed to the general shortage in the raw rubber supply, but is partly also due to the great purity of the plantation article. It can be used directly for making rubber solution and is largely bought up for this purpose. Wild Para has first to undergo the laborious process of cleaning.

If plantation rubber had appeared in quantity ten or fifteen years ago, it would most likely have had a harder uphill fight to find a good market. The supply of Brazilian Para relative to the world's demand was then much greater. Manufacturers would have been chary about risking their money and reputation on an untried raw material. For the planting community, then, it would seem that cultivated rubber has arisen at a most opportune time. Manufacturers are obliged to turn their attention to it, and by doing so must hasten on improvements in its preparation, so that ultimately it will take a place in the rubber market second to none.

Though the best grades of plantation rubber have almost invariably received a higher price per pound than fine Brazilian Para, yet the buyer is in reality purchasing the cultivated caoutchouc at a rather cheaper rate, for the wild rubber suffers a loss of 10 to 15 per cent. of its weight in washing, whereas the plantation product loses hardly 1 per cent. Rubber planters will not be content to rest till their article fetches a relatively higher price than fine Para.

The influences above mentioned no doubt keep the value of plantation rubber intrinsically rather lower than that of the Brazilian export; but at the same time there is a general impression that the former lacks to some extent the strength and elasticity of the latter. This is at present a much disputed point. But taking into account both the general bias of manufacturers for the well-tried wild article and also the variety in shape and quality of the cultivated rubber now on the market, there would seem to be little ground for regarding the best grades of plantation as inferior to fine hard Para. A fair amount of badly prepared

and "tacky" rubber from the East has reached Mincing Lane from time to timo, and this must tend to damage the reputation of plantation Para as a whole. It may be claimed, however, that previous to the arrival of cultivated Hevea rubber from the East, no raw caoutchouc so free from impurity and moisture and so pale in colour had ever been put on the market.

The youthfulness of the trees from which the majority of plantation rubber is at present obtained had been blamed for this supposed lack of strength, The tapping of cultivated Heveas is hegun when their stems, at a height of 3 feet from the ground, have attained a girth of about 20 inches. They reach this size under favourable conditions of growth in five or six years from the time of planting. The rubber in the forests of the Amazon is collected from much older trees. Then it is an undouhted fact that ruhher from quite young trees or twigs of Hevea is very deficient in elasticity. There has consequently been much opinion expressed to the effect that the latex takes some time to mature and so naturally it is argued that the rubber from old trees must be hetter than from young ones. But the botanical fact is lost sight of that new laticiferous elements are continually heing added by the cambium to the bast, no matter what age the tree may he. These must take time to mature. Previous to their full development they are not likely to yield an appreciable quantity of latex. Hence, unless the latex alters its character as the tree grows older, there is no reason for thinking it is less mature in a six or ten year-old tree than in a 15 or 20 year-old one; both will have immature laticiferous tubes as well as fully functional ones.

The reason why the latex from young stems and shoots yields an inferior rubber may be associated with the fact that this latex is contained chiefly in the tubes formed in primary growth. These may quite well differ in the contents from those produced in the so-called secondary growth, which is due to the activity of the cambium and by which the tree increases its girth. If there be any truth in this supposition, then this will account for the fact that the rubber from Hevea trees under four years old, and especially of Castilloas of a similar age, is midway in strength between that from the shoots and that from older trees. In such young trees the primary laticiferous tubes will still be yielding some latex, which will mingle with that from the secondary tubes, giving an intermediate product. Later the primary ones will become wholly compressed by the growth in thickness, and cease to give any latex.

Further, direct testing of the rubber seems now to be dispelling this notion of an inferiority in the caoutchouc from six to ten-year-old trees, as compared with that from older ones. Beadle and Stevens (Beadle and Stevens, *Chem. News*, 1907, 96, 37, 187) have carried out interesting vulcanisation tests with plantation rubber and fine Para. They argue rightly that, as almost all rubber is vulcanised before use, the trials of comparison should be made after, and not before, vulcanisation. Their results are distinctly favourable to plantation rubber. Tests for tensile strength and elongation at the moment of rupture gave results equal, if not superior, to those of fine Para. They consider therefore that the statement that plantation rubber is wanting in "nerve" is not justified, and conclude that the new product will turn out to be at least as good as, if not superior to, Brazilian fine Para. The variation in the quality of plantation rubber which is to be observed at times should be attributed rather to differences in the method of treating the latex than to the age of the trees.

Synthetic Rubber.

The possibility of the production of a commercial synthetic caoutchouc to compete with the natural article has at times perturbed the rubber-planter. A few years ago the forthcoming of an artificially prepared product looked more hopeful than it does now, In the first place a distinction must be drawn between a laboratory prepared and a commercial synthetic rubber. The former has been an accomplished fact. Bouchardat as far back as 1878 had noticed that a tough elastic solid, resembling India-rubber was produced by the action of strong acids on isoprene for a number of years, and credit is due to Prof. Tilden for his work in this direction; no one since apparently has advanced further than he did. A synthesis of caoutchouc occurred in his laboratory by accident. Engaged at one time in researches on the terpene series of hydrocarbons, he noticed that some liquid isoprene which had been laid aside in bottles for several years had formed clots of solid substance which had the composition and properties of india-rubber. He set to work to investigate the matter and found that isoprene could be changed into caoutchouc in two ways: either by very slow polymerisation in the presence of a trace of acid, such as had occurred in his laboratory by chance, or by bringing isoprene into contact with strong aqueous or moist gaseous hydrochyloric acid. The first method is not a practical one on account of the long period required, and the second could not be made a commercial success, as the caoutchouc is merely a small by-product in the formation of isoprene hydrochloride; and further the yield of isoprene from the turpentine—the starting point of the synthesis—does not probably exceed 10 per cent under favourable conditions. Tilden confesses that after two years' experimentation he had to reluctantly abandon the subject, seeing no way of making synthetical rubber commercially possible.

Even if future research should result in the production of artificial caoutchouc in quantity, it is very douhtful if it could ultimately compete with natural rubber, especially the plantation variety, as this most likely could be sold with a fair profit at a price of 3s or even 2s 6d per lb. Tho raw material required for the synthesised product might cost nearly as much. Then again, though the artificial rubber might appear, as far as chemical analysis could show, identical with the natural article, it might bo lacking in the essential physical properties. The synthesis of a colloid liko caoutchouc, presumably of high molecular weight, is a problem of a

different order from that of such comparatively simple crystallisable bodies as vanillin or even indigo.

However, at the present price of rubber, a synthetic commercial rubber of passable physical properties would not only be a boon, but a lucrative discovery. Patents have been taken out, and even companies floated for the production of synthetic rubber, but nothing visible has appeared as yet!

It is important also here to draw a clear distinction between a true synthetic caoutchouc and the so-called artificial rubbers. These latter are merely substitutes or adulterants, and would be discarded if raw rubber were cheaper. They are prepared chiefly from oils, linseed being considered the best.

It is, of course, not the purpose of this paper, even if the writer had the necessary knowledge, to deal with the chemistry of caoutchouc. This part of the subject has already received full treatment in the pages of *Science Progress*. Suffice it here to say that through the important researches of Prof. Harries, attention is now being directed towards the synthesis of caoutchouc from carbohydrates. This investigator has shown good reasons for regarding caoutchouc as related to the pentoses, and so it is suggested that in the plant it may be derived from such sources.

Concluding Remarks.

This new industry then appears to have a most hopeful future before it. The time, however, has by no means arrived when Managers of estates can content themselves with any rule-of-thumb methods. Eastern planters seem fortunately well alive to this, and now recognise the value of true scientific help. A Manager of a well-known estate has recently put in print some admirable "Conclusions" on rubber cultivation. One of these reads :—"The text-books on rubber-planting should only be regarded as historical works"—a maxim, I venture to say, of wide application.

Everything connected with this novel cultivation is still largely in the experimental stage. It is a pleasing sign to see Directors of Companies deliberating upon the advisability of employing scientific experts on their estates. Considering that such enormous profits are now being made by the older Companies, a small fraction of their receipts might well be spent in this way. Planters should not be content with the scientific assistance rendered by the Government alone. A superintendent of an estate has not the time at his disposal, nor probably the necessary training, for carrying out laboratory experiments, or for keeping a sharp look-out for the initial stages of disease—a vital point. Joint experts for several neighbouring estates might well be employed. Money so spent upon plant sanitation should be regarded in the light of insurance.

It is also gratifying to note that this new tropical industry is almost wholly of British origin. The seeds were collected in Brazil and transhipped by an Englishman. Kew raised the young plants and sent them to the Middle East. The Botanic Garden Departments there took charge of the trees and made the first tests upon them, bringing their cultivation to the notice of the planting community. The planters, once realising the possibilities of this new undertaking, took it up with their characteristic energy and daring, and have already brought it to a surprisingly successful issue with bright prospects opening ahead. Thus as a nation we have taken the lead in this new cultivation. May we not lose our hold upon it through paying too much heed to immediate gains, and too little thought to the more distant future!

The subject has further an Imperial aspect. The foundations have now been truly laid for making the British Empire before long self-supporting in regard to this valuable raw material.—*M. Mail*, May 11.

STATISTICS OF PARA RUBBER.

The following figures, which include Peruvian, are compiled by Messrs. Lewis & Peat, and are for the month of April :—

Visible Supply.
(1st May.)

		1910 tons.	1909 tons.	1908 tons.	1907 tons.
Stock in Liverpool	Para	1280	720	2078	955
	Caucho	460	490	1226	480
,,	Para	510	940	1250	1040
,,	America	90	975	820	510
,,	on Continent	30	120	310	150
Afloat to Europe		2180	1920	1400	1460
,,	America	140	580	300	560
Total Visible Supply including Caucho		4690	5745	7384	5155

Receipts at Para.

	1910.	1909.	1908.	1907.
During April	3600	3760	3350	4490
Price of Hard fine per lb.	10/6	5/4¼	3/6	4/10
,, Soft ,, ,,	10/6	5/3½	3/5½	4/11

Total Crop Receipts.
(January, 1909—April, 1910.)

	1909-10.	1908-9.	1907-8.	1906-7.
Para and Caucho	35,780	34,240	32,045	33,955

Deliveries.
(During April.)

Para & Caucho	England	2680	1380	1150
	America	490	1810	920
	Continent	550	490	490
		3720	3680	2560

Total Stocks—All Sorts.
(Including Mediums.)

	1910	1909	1908	1907
London & Liverpool 30th April	2784	2249	5180	3127

Position 1st May, 1910.

Decrease in receipts during April, 1910, against April, 1909 ...	160 tons
Increase in receipts—July, 1909/April, 1910, Para sorts against last year ...	1540 do
Increase in deliveries—April, 1910, against April, 1909 ...	40 do
Decrease in visible supply Para kinds, against May 1st last year	1055 do
Increase in stock, London and Liverpool, April 30th, 1910, against stock April 30th, 1909, all sorts ...	535 do

AN EDINBURGH PROFESSOR OF AGRICULTURE IN COLOMBO.

MR. ROBERT WALLACE, F.R.S.E., F.L.S., *EN ROUTE* TO INDO-CHINA.

TO REPORT ON THE OUTLOOK FOR RUBBER.

We had the pleasure of a call last month from Mr Robert Wallace, F.R.S.E., F.L.S., Professor of Agriculture and Rural Economy in Edinburgh University since 1885 and Garton Lecturer on Colonial and Indian Agriculture since 1900. Professor Wallace was a through passenger to Saigon and was going to French Indo-China on behalf of certain English capitalists to enquire into and report on certain specific rubber areas and to

INVESTIGATE GENERALLY THE OUTLOOK FOR RUBBER IN THAT COLONY.

Thereafter Professor Wallace proceeds home by way of Japan and Canada, visiting *en route* British Columbia, where he has a fruit farm. Professor Wallace is Expert Adviser and a Director of a British Guiana Balata Company. The property is an excellent one, but labour is scarce and the directors are considering the importation of South Indian labour. Mr Wallace is probably one of

THE MOST TRAVELLED AGRICULTURAL EXPERTS ALIVE.

He was farmers' delegate to Canada in 1879, and Special Commissioner to report on the Highland Crofter Settlements in Manitoba to the Government at Ottawa in 1893; Examiner in Agriculture to the University of New Zealand, and to the Dick Bequest; Professor of Agricultural R.A.C. Cirencester, 1882-85; made agricultural investigations in Italy and India, 1887; Australia and New Zealand, 1889; United States, 1890, 1893, 1898, 1907-8-9; Egypt, 1891; Greece, 1891-92; South Africa, 1895, for the Cape Government; Canada and Mexico, 1907; Rhodesia, 1908, for the Chartered Company; Expert adviser to Victorian Government at inter-colonial cattle-tick conference held in Sydney in 1896. He is a prolific writer and has published a considerable quantity of enduring work. His book on Indian Agriculture is well-known in the East. Professor Wallace is

NOT A STRANGER TO CEYLON

having spent a fortnight here some 23 years ago and having maintained a correspondence with our "senior" for many years thereafter. Mr C Drieberg is an old student of Professor Wallace's; while in the few hours he spent in Colombo the Professor met two old friends in Messrs Greenshields and Craig.

BELGIAN CONGO TAXES ON INDIARUBBER.

About 3½d per lb. Export Tax from July 1st.

The "Moniteur Belge" for April 7th contains a Belgian Royal Decree, dated March 22nd, providing that, from July 1st next, there shall be levied on exported rubber, other than plantation rubber, collected in the Colony, a tax of 75 centimes per kilogramme when the rubber is from trees or lianas, and of 50 centimes per kilogramme on so-called rubber '*desherbes.*' These taxes are to be levied in addition to the export duty.—*Board of Trade Journal*, April 28.

PINK DISEASE OF PARA RUBBER AND BORDEAUX MIXTURE.

In my report on my tour in Travancore it was mentioned that at Palapilly Estate, the Para Rubber trees were being treated with Bordeaux mixture as a preventative to Pink Disease. Mr R T Gudgeon, the Manager, has kindly sent me some valuable information about the process. He writes as follows:—

"Painting Rubber trees with Bordeaux mixture to prevent the attack of *Corticium javanicum.*—I will answer your questions in order.

1st—"Strength of Bordeaux mixture.

6 lb of Copper Sulphate.

4 lb of freshly slaked burned lime in 45 gallons of water.

"This is what I started with, but allowing for a certain amount of Copper Sulphate not dissolving I now put 10 lb instead of 6 lb. I mix it up in lots quarter the bulk of above.

"The Copper Sulphate is dissolved in boiling water and of course in wood or enamel buckets. As a rule the whole of the water to be used is utilised first for dissolving the Coppor Sulphate.

"I put a solution as strong as I could make it on 2 or 3 four year old trees, but I found it in no way affected the bark other than slightly drying it up on the outside but nothing like so bad as tar does.

"2. The best mixture I have found and by far the cheapest, as it only cost just the cooly hire for collecting, is the bark from a tree which is locally called *Kola-Mavoo.* This put in water and kept in soaking 5 or 6 days makes an excellent paste. I had 3½ inches of rain a few hours after I had applied the Bordeaux mixture with this paste mixed with it, but one could see the mixture on the trees quite plainly after.

3. I only paint just where the branches join the main stem and over any wounds there may be on the tree.

4. "I have never tried the sprayer and should imagine it a very expensive way of doing it on large 3, 4, or 5 year old trees, as well as not so effective as the brush. There is no other waste with the brush.

5. "It has cost me about 150 rupees to do 500 acres, 200 acres of which were 2½ year old trees and cost very little. This includes labour, pan, Copper Sulphate and brushes. The amount a cooly will do is difficult to say, as it entirely depends on the age and size of the trees, and I also pruned the trees carefully as I went along, which is not included in the above cost. At least 90% of the trees were done in the older clearings, only those that had branches shooting out very high up were missed. I used about 45 lb. of Copper Sulphate, but there was a great deal of waste owing to my unfortunately not getting it closely ground and fine quality. Coolies had to grind it themselves the best way they could. Strawson's Copper Sulphate is much the best and dissolves fairly easily in cold water, but I doubt if you get it out here."

. . . . The actual benefits to be obtained from this system can only be ascertained after the monsoon is over, and I shall hope to publish the results with the kind permission of the managers of Palapilly Estate as soon as they have been obtained. I have little doubt, however, but that they will prove to be of an encouraging nature.

RUDOLPH D. ANSTEAD, *Planting Expert.*
—*Planters' Chronicle*, May 21.

COCONUT PALM DISEASE IN BORNEO.

We have lately received from a correspondent, in Borneo, an account of a serious disease in coconuts, which bears so great a resemblance to that known as bud-rot, which has hitherto only been met with in India and Ceylon, at least in this part of the world, that it seems highly probable that it is identical. Our correspondent, Mr E Hose, describes it as follows: "The leaves turn yellow and the fruit, if there is any, hangs limp, the leaves drop down and gradually die, the stem of the tree gets thinner and thinner near the top, then the centre shoot drops out, apparently having rotted; inside the heart, at the top, it is like rotten wood-mud. It seems to attack trees of any age. Trees on wet or dry land are affected by it. According to native stories, it has only put in an appearance since the last two years." A very valuable and full account of an exactly similar disease is published in the Bulletin of the Agricultural Research Institute of Pusa, No. 9, March, 1908, by Mr E T Butler, the Imperial Mycologist. He says: (p. 5) "As a general rule, the first indication that a coconut palm is attacked is the opening out of the outer leaves from the head. The leaf stalk becomes slightly flaccid and the weight of the leaf causes the whole to drop. Then the ends of the pinnae or leaflets at the extremity of the leaf become flaccid and hang down almost vertically, this is accompanied with a loss of colour, the dropping and discolouration of the leaflets then extend gradually backwards to the whole leaf. Later on, the tips of the leaflets turn yellow and dry up, followed gradually by the entire leaf, which eventually hangs down, withered, from the crown. The attachment of the leaf sheath to the tree is weakened so that the outer discoloured leaves can be easily torn from the crown one after another, or many together, all the leaves are similarly affected. . . . Gradually, as the palm weakens, new leaves that are put out are smaller than of old. This is apparent even before they unfold from the bud and results in the central shoot which is merely the unopened leafbud becoming stunted and pallid. Later on, it begins to wither and the upper tree part turns brown. Eventually it may dry up altogether, but this may not occur for many years. The top of the stem and the white internal part of the crown are quite normal, except in old cases just before death, when the latter rots. One of the conspicuous marks is the way the nuts are injured. Even in the first year or two the nuts are affected. They are fewer and smaller than usual, on splitting the husk is found unaltered and usually the shell also. The white kernel is, however, shrivelled and indurated and copra prepared from it is said to be deficient in oil. The fluid inside is reduced in quantity, and is altered in quality, becoming unpalatable to drink. In later stages, a large proportion of the nuts drop in an immature condition. In more severe cases the spathes are unable to burst out at all or if they do, rot away early and the palm becomes barren."

This description fits well the account from Borneo, and seems certainly to be of the same disease, and as it has thus approached so near to the Malay Peninsula it is very desirable that a watch be kept for its appearance here.

The disease is not situated in the bud of the tree, but in the roots, which are attacked by a parasitic fungus belonging to the genus *Botryodiplodia*, at least this fungus appears always to occur on the rotting roots of trees affected by this disease. The destruction of the lateral roots cuts off the water supply of the palm so that the bud dies of drought and starvation.

The death of the palms is very slow. "Young palms may be killed in five years, but this is exceptional. Eight or ten years appears to be a more usual period while in many cases the disease progresses enough to cause barrenness but fails to kill the tree outright. Thus, in one large garden only two hundred coconut palms were in bearing out of about two thousand, while the deaths were not numerous."

"The disease is worst in heavy alluvial valleys and poor laterite hill soils. It is least severe in the sandy soil of the littoral. There is plenty of evidence that the disease is infectious. A palm evidently affected and brought from an infected district ten years ago was planted in a garden where the trees were all healthy. A few years later, it began to turn yellow and others near by were attacked; now thirteen trees are affected and the original one is dead and the disease has spread to neighbouring gardens."

The disease attacks not only coconuts, but betelnuts, and caryotas. The treatment recommended is destruction of all diseased palms whether they be only just attacked or practically dying. The roots should be dug out and with the stem leaves burnt at once. Lime, preferably quick lime, should be well dug into the infected spot, and the ground frequently dug over to break up and aerate the soil. If necessary, the soil should be drained, as undrained or insufficiently drained soil affects the roots injuriously and the weeds on the ground destroyed, and manuring with cow dung or nitrogenous fertilizers should be tried. No plants should be planted in the infected spot for a year after the removal of the diseased trees.

As in the case of most at least of these ground root fungi, the progress is comparatively slow, so that it should be possible if taken in time to stop an outbreak with the loss of a very few trees, but in order to do this plantations must be carefully examined, and any tree exhibiting the symptoms described above should be destroyed and removed as quickly as possible.

There is another bud-rot disease in India produced by the fungus *Pythium palmivorum* in which the shoot is actually attacked by the fungus. The withering of the shoot at an early stage is the most characteristic feature. The first symptom is the turning white of a whole leaf towards the centre of the crown, the bud then turns white, rots and the crown falls off, the whole of the 'cabbage' becoming converted into a putrid, foul-smelling mass. The whole palm is killed in a few months, and recovery is very rare. But these symptoms do not seem to be identical with those of the Borneo disease. It appears chiefly to attack the palmyra palm in India but also areca and coconut.—Ed.—*Straits Agricultural Bulletin* for May.

COCOA AND COCONUT PRODUCTION IN 1909: IN THE PHILIPPINE ISLANDS

The British Acting Consul-General at Manila (Mr E L S Gordon) has forwarded the following particulars of the production of cocoa and coconuts in the Philippine Islands in 1908 and 1909, the statistics given being based on information supplied by the Bureau of Agriculture :—

COCOA.—Cebu is the chief cocoa producing province, the output in 1909 being 94,491 lb.; Oriennal Negros came next with 49,680 lb., and Pangasinan with 20,135 lb. The area under cultivation was 4,509 acres in 1909, as against 3,477 acres in 1908. The total production of cocoa was 334,094 lb. in 1909, as compared with 210,859 lb. in 1908.

COCONUTS.—The principal coconut producing provinces are those bordering on the Pacific Coast, with the exception of La Laguna, which produced last year over 20 per cent. of the total output of the Islands. The total production of the Islands amounted to 103,826 tons in 1909, as compared with 102,847 tons in 1908.

The Director of the Bureau states that considerable experimental planting of coffee and cocoa has been going on during the past few years, and the output in the near future should show the effects of this.—*Board of Trade Journal*, May 12.

THE FOOD VALUE OF COCONUT MILK.

There is an enormous amount of waste of valuable food material in India in one direction or another. This is because people do not know the food-value of the material thus wasted. One such is the water, or milk, of the coconut. During the hot months of the year in Bengal, but in Calcutta especially, the people consume large quantities of the water in the young coconut, called "Dawbs." It is asserted that the water of one or two "dawbs" enables a poor man to go without solid food for a day. To test the truth of this a reference was made by us to Mr. D Hooper, F.C.S., of the Economic Museum, Calcutta, who has very kindly supplied the following interesting information :—'I have made no analyses of coconut milk, but it has often been examined by chemists in other parts of the world. Professor Van Slyke in America, for instance, examined the milk of unripe and ripe nuts, and found the following constituents :

	Milk from Unripe nuts.	Milk from Ripe nuts.
Water	94.37	91.23
Ash	.61	1.06
Glucose	3.97	trace
Cane sugar	trace	4.42
Proteids	13	29
Fat	.12	.14

"You will thus see that the milk contains all the elements of nutrition—proteids, fat, sugar and minoral matter. The milk of the ripe nut contains more proteids and ash, and, strangely enough, the sugar becomes changed in the process of ripening from amorphous glucose to crystalline cane sugar." It is the milk of the ripe nut that is wasted in such large quantities in the markets of Calcutta especially, and in Bengal generally. If some process could be discovered of preserving this milk intact, a highly nutritious beverage would be added to our dietary. —*Englishman*, March 11.

ESTATE CULTIVATION: THEORETICAL AND PRACTICAL.

In response to a request that he should supply information on the subject of estate cultivation, Mr. J. A. Holmes, of the Experimental Station, Peradeniya, has sent the "Times of Ceylon" in response to an enquiry following information gleaned from the observations of the most eminent agriculturists, theoretical and practical:-

The relative value of manures may be arrived at either by regarding their relative effect on crops, or by reference to the market price of their constituents; the two methods do not necessarily give the same result, though they naturally tend to agreement. Wagner, as the result of numerous experiments with nitrogenous manures applied to crops, and continued for several years, gives the relative value of nitrogen in various forms as follows :—

Nitrate of sodium	..	100
Sulphate of ammonium	..	90
Green crops	..	70
Steamed bone dust, fish manure, meat guano		60
Farmyard manure	..	45
Wool dust	...	30
Powdered leather	..	20

Whilst the land is continuously covered by vegetation the loss of nitrates by drainage will be reduced to a minimum. The accumulated nitrogen will be chiefly in the form of grass roots and stems, and humus. When such land is forked, the vegetable matter and humus are oxidised, and gradually yield their nitrogen as nitric acid; the ash constituents which they contained are at the same time liberated, and become once more available as plant food. The nitrogen collected is kept in an insoluble form, as vegetable mattert and consequently cannot be washed away, bur accumulates in the surface soil to a greate, extent than is possible in clean-weeded land. Humus is also produced in considerable quantity.

Leguminous crops have a special power of acquiring nitrogen from the atmosphero by means of their root-tubercles, and are hence of the greatest value. The accumulation of nitrogen in the surface soil in the form of roots, stubble, and decayed vegetable matter is, in the case of a good crop of green manure, so considerable that the whole of the above-ground growth may be removed and the land yet remain greatly enriched with nitrogen. The growth of leguminous crops is the most important means which a planter possesses for enriching his land with nitrogen. The characteristic advantage of green manuring lies, however, in the large amount of humus which the soil acquires. All the carbon which the crop has obtained from the atmosphere is incorporated with the soil. Green manuring is thus especially adapted for light, sandy soils, which need humus to increase their retentive power. It is employed with great advantage to fertilise barren soils in hot climates. Leguminous crops are clarly to be preferred before all others for the purpose of green manuring, as in their case nitrogen is obtained from the atmosphere.

It may also be of interest to planters to know that the ordinary clean-weeded, drained rubber slope, if the washed soil is not caught in pits and redistributed about the land, loses well over R200 worth of manurial constituents per annum.

SINGLE PLANTING OF PADDY.

USEFUL INFORMATION.

The following Press Note has just been issued by Mr M E Couchman, I.C.S., the Director of Agriculture in Madras :—

So much has been written of late regarding the best method of bringing improved methods of cultivation to the notice of the cultivators, that the following brief note on the attempt which is now being made to popularise the single planting of paddy in the Tanjore District may be of general interest.

During the past three years the advantages of planting single seedlings of paddy, in place of the customary bunches of twenty or thirty, has been brought to the notice of the educated public, through the Agricultural Calendar, leaflets, Press communications and tours by officers of the Agricultural Department, supplemented by the efforts of the Kumbakonam Agricultural Association. As a consequence, small plots planted on this system may now be seen in many parts of the Delta during the crop season.

With a view to expedite the spread of the practice among the agricultural population at large, a special leaflet has been prepared by the Deputy Director of Agriculture, Southern Division, giving simple instructions to those who wish to try it. This has been translated into Tamil, and 100,000 copies struck off. Some of these will be distributed by the agency of the Revenue Department, but the greater number will be given direct to the cultivators in the villages by agents of the Agricultural Department. Three subordinates who have had special training in the subject have been selected to tour through the three Taluqs of Shiyali, Kumbakonam and Negapatam. At each centre they will assemble the leading cultivators and discuss with them the subject of reducing the present seed-rate and adopting the practice of single planting. Each will be supplied with a sufficiently large number of the leaflets to enable him to give a free copy to everyone who shows any interest in the subject. The advantage of distributing the pamphlets by hand in this manner, by trained men who have made a special study of the subject, is that they will be able to meet the objections raised by the sceptical, and to supplement by personal advice, based on experience, the instructions contained in the pamphlet.

It may not be out of place to recapitulate the reason why so much importance is attached to the subject. The first is the waste of seed under the present system. For transplanting one acre of land upwards of 120 to 200 lb of seed is used in Tanjore. Yet in the Kistna District, where single planting has been the custom from time immemorial, 14 lb of seed is found enough for one acre. No one who knows both districts would maintain that the average crops in Tanjore are as good as those in Kistna, though the soil of the Kaveri Delta is probably better on the whole than the soil of the Kistna Delta, as it is more loamy and better drained. The few individuals, who have given single planting a fair trial in Tanjore, have been satisfied that they get better crops than before. It follows, therefore, that at least 100 lb of seed is wasted for every acre of wet land in Tanjore. According to the latest satistics, there are 1,043,930 acres under paddy cultivation in Tanjore. The present system of planting in Tanjore is, therefore, responsible for the annual waste of more than 100,000,000 lb. of paddy. At the present wholesale price of 26 lb. per rupee, the value of this is no less than R35 lakhs, equal to a self-imposed cess of R3·8 per acre on every acre of wet laud, and sufficient to feed the population of the whole district for nearly three weeks. Apart from the saving of seed, better crops are usually obtained from the singly-planted crops than from crops planted in clumps containing from 20 to 30 plants. Many of these plants die at once; others struggle on for a longer or shorter time, and produce no ears, but by competing with the other plants in their clump for food, light and air, they weaken these and reduce their yield. The grain produced under these conditions is of inferior quality and weight to that produced by plants which have sufficient space for their full development from the start.

The subject is of national importance, and it is hoped that the special measures now being taken to advocate a more rational system will receive sympathotic consideration from all who are interested in the land.—*M. Mail*, May 14.

GROWTH OF PARA RUBBER.

SOUTH INDIAN NOTES.

Kutikul Estate, Mundakayam P.O., Travancore. S. India, April 27th, 1910.

From observations made after a series of measurements extending from August 1908 to February 1910 I have come to the conclusion that it is possible to determine very closely the approximate growth of Para Rubber, growing under normal condition (Lowcountry), one year in advance, thus giving estate managers an opportunity of fairly accurately forecasting the amount of crop obtainable, and the number of tappable trees they will have, one year from date of measuring. It was in comparing the circumference of trees at the base in August 1908, with the measurements obtained from the same trees at 3 feet from the ground the following August, 1909, that a similarity was first noticed. Later on, the basal measurements of other trees were taken and compared with the 3 feet circumference measurements a year afterwards, and these too were found to be similar, showing that, under ordinary conditions, we may assume that the figures of one period's basal measurements will approximate the figures of the same trees at 3 feet from the ground one year later. That this discovery is valuable, if proved correct, will be self-evident to every estate manager who has to make an estimate of amount of crop and cost of production a year or 6 months ahead. That this theory holds good on estates at an elevation of more than 1,000 feet is not claimed, and as far as is known it is only applicable to estates at a low elevation. The figures given below are taken from measurements of trees on an estate 500 to 750 ft. above sea level.

Average basal measurements Trees Nos. 1 to 20 August 1908 (Planted 1906)	3 feet from ground measurements from same trees August 1909
Inches 10·33	Inches 10·02
Same trees February 1909	Same trees February 1910
Inches 12·07	Inches 11·45
Average basal circumference 20 trees August 1908 (Planted 1907) 5·08	Same trees August 1909 (Planted 1907) 6·16
Same trees February 1909	Same trees February 1910
Inches 7·15	Inches 7·13

(Signed) J. R. VINCENT.

—*Planters' Chronicle*, May 14.

RUBBER IN THE F.M.S., JAVA AND SUMATRA.

MR. F. COPEMAN'S VIEWS.

Mr F Copeman, of Messrs. Maclaren and Sons, manager of the *India Rubber Journal*, and director of some eighteen rubber companies, has arrived in Ceylon after a tour in the Federated Malay States, Java and Sumatra with his son Mr. H F Copeman, who, we regret to hear, was laid up with fever in Sumatra for a fortnight.

Speaking to a *Ceylon Observer* representative, he said that he had visited several of the big properties in the Klang district, in Malacca, in Perak, and in Province Wellesley. He had spent five or six weeks in Java, going right through the island and seeing all the best rubber estates, and in Sumatra he had been to nearly all the best.

TAPPING.

In regard to tapping he had found that a very common form everywhere now was the half-herring bone and the basal V on trees of small girth. On some estates, especially native-owned property in the F.M.S., they were tapping trees of too small a girth. On one native estate he saw trees ten inches in girth being tapped with a basal V three feet from the ground. There was very little tapping in Java. Tapping on anything like an extensive scale had not been done yet, but it might be expected at the end of this year. The growth there was slow although the soil of the mountains of Java was superior to the soil of the hills of Ceylon. Some of the finest soil in the world was on the slopes of the Yang Mountains in Java. There trees four years old were being tapped at an altitude of about 1,200 feet. In Sumatra tapping was more carefully done than in any of the countries he had visited. The half and full herring bone systems were used and there were very fine yields.

GENERAL CULTIVATION.

Speaking with regard to general cultivation Mr. Copeman said that so far they had not, in the F. M. S., Sumatra and Java, gone in for intensive cultivation to the same degree as in Ceylon ; in fact, it was quite exceptional to hear of manure being used. The reason manure was used so much in Ceylon was, probably, that the soil of Ceylon was not nearly so good as that in other parts of the East. In the growth of the trees other countries beat Ceylon easily on account of the soil, not because greater care was taken in cultivation. Ceylon agriculture was known the world over as the best.

In Java rubber was generally grown with a catch crop and the same applied to a certain extent to Sumatra. In the former country they were cutting out a good deal of the old Java coffee and substituting *robusta* coffee, which gave an enormous yield. If the rubber were planted in the old coffee land unquestionably the growth was slower ; but if the coffee and rubber were planted together, he did not think there was very much difference between such rubber and that planted alone, provided always that wide planting methods were adopted. He did not recommend anything closer than 20 ft. by 20 ft. or 16 ft. by 24 ft. In planting *robusta* coffee as a catch crop it was best to plant between the rows, and not in the row, because when the coffee grew up and the rubber began to come into bearing, it interfered with the supervision of tapping operations. In Ceylon the catch crop, of course, was nearly always tea. In some parts of Java cacao was grown very successfully, as an inter-crop rather than a catch crop. Most of the estates in the F.M.S. were growing rubber alone. In Malacca and Province Wellesley tapioca was grown as a catch crop and, in some notable cases, sugar.

THE PREPARATION OF RAW RUBBER.

"I do not see any difference worth naming in the preparation of raw rubber," said Mr Copeman, in response to further questions, "the methods are much about the same. I hold that although Ceylon may be a year or eighteen months behind the Straits and Sumatra the Ceylon rubber, when it comes into bearing, will be found to be every bit as good, and the yields, I should think, will be about the same."

PLANTATION RUBBER.

"I stand by plantation rubber. I do not want to express any opinion with regard to recent flotations, being interested in flotations myself, but I stand very firmly indeed by plantation rubber and believe in its future. I would place first the Klang district of the Federated Malay States, after that Sumatra, and Ceylon last, behind even Java. When Ceylon rubber comes really into bearing I do not think the yields will be any less than those obtained in the Straits and Sumatra but as a rubber growing country I prefer the Federated Malay States and Sumatra."

THE FUTURE OF RUBBER.

"As far as the price of rubber is concerned," added Mr Copeman, "I do not see any prospect of an immediate fall or of any very substantial fall for the next year or more. After that I do think we shall have a very substantial fall and I think the price will gradually come down. I think that the highest price has now been reached. I cannot see any immediate substantial fall. Not only are the present prices absolutely abnormal but the increase in consumption during the past few years has been very gradual, we have never had a very big increase. I do not think the supply will be too great for many years to come because of the many new uses to which rubber can be put. Plantation rubber will pay well when wild rubber will not pay for the collection.

TOBACCO GROWING IN BURMA.

A FALLING OFF: IN SPITE OF PROTECTION.

A correspondent writes to the *Rangoon Gazette* :—"It is remarkable that at a time when an important duty on tobacco imported by sea has been imposed, the production of locally grown tobacco in Burma should have fallen off by close on 5,000 acres. The offical report gives the total acreage under tobacco in 1908-09 as 58,103 acres whereas in the previous year the figures were 63,070. All districts in Burma grow tobacco except three. The largest acreage is given as in the Henzada District. There is no doubt much grown in Aungyi, as in the hilly parts of the Province, which escapes enumeration. The difficulties in raising an excise tax on tobacco grown in the more remote parts of the Province would be enormous.—*M. Mail* May, 17.

RUBBER CULTIVATION IN TRINIDAD AND TOBAGO.

MR. J. B. CARRUTHERS ON TAPPING CASTILLOA.

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PLANTATIONS IN TRINIDAD AND TOBAGO.

Rubber planting in Trinidad and Tobago is in its infancy, and owing to lack of confidence or the necessary technical knowledge in cultivation and extraction of latex the progress has not been very rapid. There are at present in Trinidad some rubber trees of ages varying from one to fifteen years of the following species, and the following figures have been returned in answer to circulars from the Department :—

Hevea 80,000. Castilloa 600,000. Funtumia 25,000.

It is not possible to compare the growth of these trees with those of similar age in Eastern plantations because in the latter countries the trees have been grown from their being planted as stumps, on clean weeded land and the height and girth under these conditions is much greater than in the case of trees surrounded by weeds or shading the soil with other trees and shrubs.

I have recorded very few measurements of trees in what is termed in the East "abandoned land"; and this is unfortunate, as these figures would be of use to compare with trees in Trinidad and Tobago which are growing either surrounded by weeds periodically "brushed" generally in association with Cacao, Erythrina (*Bois immortelle*), Banana and other plants. From general observations, however, I am of the opinion that the growth of Para rubber under the local conditions is very little if at all inferior to that of the trees of the same species in Malaya and Ceylon treated in the same way. Of the relative growth of Castilloa I have still less reliable data to form an opinion, but observations in different parts of Trinidad and Tobago lead me to the belief that Castilloa and Hevea (Para) grow equally well and vigorously here. It is true that in places Hevea seems to thrive more than Castilloa, but the reverse can be observed and I do not think there is any reason to suppose that, taking the island as awhole, either plant grows more vigorously than the other.

HEVEA OR CASTILLOA?

The decision for intending rubber planters, as to which plant may be expected to prove more profitable, is not easily settled. The chief arguments in favour of Hevea are :—That it grows vigorously on comparatively poor soils which are well drained. That the yields of rubber from trees already tapped, as far as they have gone, compare favourably with those of similar age in other countries. That the method of extracting the latex from Para rubber trees has been brought to a degree of perfection which, though still capable of improvement, is eminently satisfactory and practical. Against this, however, as previously mentioned, is the argument that these methods of extracting the latex from Para involve a large amount of regular daily labour which we cannot hope to reduce by mechanical means. That the rubber of cultivated Para trees has secured a high place on the markets of the world as a valuable rubber, and is in continual demand by the manufacturer. That the coagulation is easy and the preparation of dry rubber a well understood and easy process.

The arguments against Para as compared with Castilloa are, that the supply of seed locally is limited and importing from the far East is by no means an easy or certain way of getting plants. That the plant when young is greedily eaten by almost all animals. I have seen many thousands of plants in a large nursery browsed down by a cow, and deer, monkeys, pigs, &c., are very fond of the plant.

The arguments in favour of planting Castilloa elastica are to some extent more based on expectation than on exact data. The tree grows vigorously and in some cases when side by side with Hevea compares favourably with the latter. An almost unlimited supply of seed and young plants is available. The important question of probable yields is not an easy matter to express an opinion on. Large plantations of Castilloa exist in Mexico and other countries; but figures of the yields, as far as they are obtainable, do not show anything like the return which Hevea has given in Malaya and Ceylon. The differences in the returns from large areas in Mexico Castilloa and Malaya Para are enormous. In the latter country in one State, Negri Sembilan, 300,000 tapped trees gave an average of 2 lb. 7 oz., per annum, while the highest Mexican figures on a sizeable area I have seen are ¾ lb.

The results of all observations and experiments which have been carried on in Trinidad and Tobago are most encouraging in regard to the amount and quality of the latex in the tissues of Castilloa trees of age and size, but the methods of extraction are at present by no means satisfactory. I carried on very few experiments or observations in extraction of latex from Castilloa when in the East the planting of that tree not being considered as against Hevea.

Since my arrival in the West Indies I have been making many tentative experiments and observations as to tapping Castilloa, and am of the opinion that the methods which have been used for extraction of latex up to the present are unsuited to the structure of the tissue of Castilloa and the arrangement of its latex vessels. The use of the knife in Hevea causes little or no gaping of the wound, and the bark tissues can be cut smoothly and very thin. In Castilloa the fibrous character of the tissues makes it difficult to cut clean or thin and there is always a widening of the wound which takes a long time to heal and is the potential harbourer of insects, fungi and other undesirables. For these reasons I am inclined to believe that if the latex can be extracted with a minimum of wound to the tree, and at the same time by a process which can be done quickly, and is therefore labour-saving, a great advance will be made in the methods of tapping Castilloa.

TAPPING OF CASTILLOA.

Being of opinion that the cutting or slicing of Castilloa bark was unsuitable, I began soon after my arrival a series of experiments on individual trees with sharp pointed weapons of differing dimensions, all of which were meant to penetrate right down to the old wood, with as small a puncture as possible.

Can the latex be so extracted with success? It is too early to be at all confident, but the

tappings with various crude instruments I used at first gave excellont results per square inch of bark tapped. I have recently received from England a series of instruments made from my designs, in which the pricking points, varying in size and length, distributed on rollers, can be forced into the bark making equidistant punctures all over the surface of the trunk.

When I have carried on a series of exact experimental tappings with these new tapping instruments and discover which of the pricking points is the most effective, and at what distance the punctures should be made, an account will be published in detail, and it is therefore not necessary here to go further into the question.

It would be premature to make any estimate of the quantity of the latex which may be expected from these pricking methods, but results on small areas of bark in one pricking have given yields which when multiplied by the difference between the area tapped and the area available amount to from ¾ to 2¾ lb. per tree inoue tapping.

It must, however, be explained in connection with these preliminary experiments over a small portion of the area of the tree that it is improbable that the whole area will give as much as the multiple of the amount recorded from the smaller area. In the latter some latex comes from an area outside the tapped and measured portion. Mr Smith of Tobago, who has carried on experiments as to this method of tapping, supports this and informs me that a trial of the whole area on a tree in his estate showed a less amount than that obtained from a portion.

The question as to whether the maximum of latex can be extracted by pricking the whole as against treating a portion, say half or one-third, of the tapped area of the tree is one which must be determined, and in a series of experiments which I have planned and which will be carried out by the permission of the owners on six different rubber plantations of trees of eight years and older, this problem will, I hope, be solved.

I hope that such experiments will be carried on by all planters having tappable Castilloa trees, and it will be of much assistance if any carefully recorded data as to yield by pricking or any other process can be sent to me. In order to get the best yields from the pricking method the tree must be occasionally sprayed with water during the tapping process until the latex ceases to flow, this will be found to largely increase the amount extracted, the holes by this means being kept open and the rubber not allowed to coagulate in them and thus stop any further flow.

My experience on this point has been that while tho flow from punctures properly made and without spraying or watering will flow for some 15-25 minutes, if coagulation is prevented by applying water the flow will continue from 50 75 minutes and will result in some 30 per cent. to 40 per cent. more latex.

With regard to methods of planting I would strongly advise the planting of rubber by itself on the land and not in conjunction with other trees. Mixed cacao and rubber plantations rarely do justice either to the one or the other cultivation. The rubber should be planted in the open without any shade over it at all, and the method of planting stumps which has resulted in such excellent plantation of over 300,000 acres in Malaya, will probably be found to be the best here. The stumps used are plants from the nurseries of six to eighteen months old from which the green portions have been cut and the roots roughly trimmed, the result being a stick of about ½ in. in diameter from 4 to 5 feet high. These, when planted in the field in suitable weather, should strike and produce leaves within a few weeks.

The field must be prepared for tho rubber some months before they are planted ; and if it is virgin jungle, the best method will be directly after it has burnt off to establish by sowing broadcast or by planting whatever cover plant is selected as the most suitable.

When once the cover plant is thoroughly established, the field needs no more attention, and when the stumps are ready, and good planting weather is anticipated, they can be put out without materially disturbing the cover on the soil.

DISTANCE OF TREES.

As to the distance of planting, like most agricultural problems it admits of argument. The reasons against close planting, *i.e.*, 12 x 12 feet or closer (302 to the acre) are : That it prevents the tree from growing to full vigour and to the greatest possible size, forcing it to run up to the light and giving no room for lateral branches. That it increases the cost of collection of rubber since a larger number of trees have to be tapped for the same amount of rubber. That if it is found necessary to give the trees more room the cutting out of a proportion of them is fraught with much danger to the remainder, inasmuch as each dead rubber tree root or portion of root is a potential centre of root disease fungal or insect. To plant more rubber trees than it is intended to permanently keep on the estate and afterwards by cutting out reduce the number is a dangerous policy. All acquainted with diseases in plants will agree that to leave the dead roots in close proximity to roots of living trees of the same species is most likely to encourage root fungus and insect pests.

If a planter finds it necessary to give more growing room for the branches and leaves of some of his trees, it is preferable to pollard some allowing them to grow slowly underneath the branches of the unpruned trees, rather than by cutting them out to leave the decaying roots dotted all over his fields. That the admission of sunlight freely as is possible in a plantation of rubber with trees 20 to 30 feet apart is a safeguard against the attacks of parasitic fungi.

The advantages claimed for close planting are that it gives for first years of tapping a much larger yield per acre. Evidence in eastern plantations point to this being true during tho first 4 or 5 years but the additional cost of tapping and the probability that this result will not be so marked as the troes get older to a great extent modifies this reason for close planting.

I would have preferred to postpone the writing of these notes of rubber cultivation until I had more exact data upon which to base my opinions, but the number of queries with regard to the possibility of rubber in Trinidad and Tobago, both locally and from England, seem to necessitate some report as to the position up to the present. Our definite knowledge is at

present very scanty, and accurate and reliable data must be gathered by exact observation and experiment. The position in regard to the rubber industry in Trinidad is not unsimilar to that which obtained in Ceylon and Malaya some ten years ago. The mass of statistics and observations which have been carried on by the scientific officials of these places, as well as by intelligent and painstaking planters, has given these countries an industry upon which they have exact knowledge and the prospects and profit of which they can accurately gauge.

It is, however, certain that both Hevea Brasiliensis (Para) and Castilloa elastica grow vigorously and yield latex in good quantity in Trinidad and Tobago. No data exists as to yields, only spasmodic tappings having been made and no rubber has been prepared but by the crudest methods; but all these attempts have been encouraging and contain no evidence that the trees of Trinidad and Tobago possess any less of the profitable characters than the Para and Castilloa trees of rubber-producing countries.

Future Experimental Work.

Through the kindness of Mr Boos, I have had placed at my disposal for experimental purposes 97 Para rubber trees of 9 or 10 years old, averaging in girth at 3 feet from the ground 2 feet 10½ inches, and at the base 3 feet 8½ inches. I am making arrangements to carry on a continuous series of tappings every other day for two years or more, and all data of yields, quality of rubber, &c., will be carefully recorded.

I propose to begin a series of experiments on a large scale with Castilloa directly the experiments I am carrying on with a small number of trees have given some information as to the best shape of puncturing instrument and the most effective way of forcing it into the bark.

For this purpose the estates below mentioned have placed plots of trees at the disposal of the Department of Agriculture and therefore while regretting the lack of information on important points which this paper show I hope that in the course of a few months the knowledge which we so much desire may be obtained. The planter who is at present waiting timidly on the bank will be encouraged to plunge and will also have figures to enable him to choose between the rival merits of Hevea and Castilloa:—

Santa Aneta	Longdenville	Mr F Boos.
Santa José	Guaico	Mr J G de Gannes.
Verdant Vale	Arima	Mr J Wade
Poole	Savana Grande	The Poole Estate Syndicate.
Richmond	Tobago	Captain Short.
Louis D'or	Tobago	Mr T W M Orde.
Monte Cristo	Cumuto	Mr H Monceaux.

The illustrations distributed through this issue show the various species of rubber cultivated in Trinidad. In all cases the plants have been grown without continuous weeding, and this factor should be taken into consideration in considering the size of the trees as compared to trees of the same species in other countries.

Plate	1—Castilloa elastica	6	years old.
,,	2—Funtumia elastica	3½	,,
,,	3—Castilloa elastica	6	,,
,,	4— ,, ,,	12	,,
,,	5—Hevea brasiliensis	3	,,
,,	6—Funtumia elastica	12	,,
,,	7—Castilloa elastica	20	

J. B. C.

—*Trinidad Bulletin of Agriculture*, April 1910.

CASTILLOA RUBBER.

DISAPPOINTING EXPERIMENT.

The *Indische Mercuur* quotes a speech made by Mr. Tobias, at a meeting of the Mountain Cultivation Section of the Agricultural Union at Djember, on the subject of the cultivation of Castilloa, which contained the following:—

The cultivation of the Castilloa was held to be of little account at the last Rubber Congress in 1907. It was barely mentioned. A few planters had yet tapped it, so results could rarely be reported. Although I could have started early to tap, I made several journeys to other lands to learn how to handle it. And with several rounds of visits at my back and a number of figures which I took down I was able to compare my experience with those of other planters.

Amongst the plantations visited was the Simo, where a beginning was made with planting the Castilloa in 1899, so the oldest trees have about ten years' growth. As many as 3,606 of them have been tapped, with a result of 113½ lb. good rubber, and 42 lb. scrap, or 21½ grammes per tree about. On the Soember Telogo estate, about 1,800 to 2,000 feet high, the first planting of Castilloa took place in 1901. Fresh planting was done in 1903 and 1904, and in the early part of 1909 there were 9,080 trees ready to be tapped. The first tapping took place in 1908. But the first yield was not clean. It was not rolled out, and so was full of watery hollows, and even the later yield of tappings could not be called dry. The proportion of latex to dry rubber was 6¼ to 1, and the yield per tree was about 10 grammes.

At Kali Mrawan, on spurs of the Majang Mountain range, the Castilloa trees are on rough ground, about 1,000 to 1,600 feet high. The first were planted there in 1900; then followed plantings in 1901, yearly on to 1905, and then again in 1908. The oldest (about 7½ years old) trees were tapped in 1909, when 156½ grammes latex were collected, or about 19½ grammes dry rubber per tree. The second tapping yielded only 16 grammes per tree. The six, five and four-year old trees were also tapped in order to learn the quality of rubber from young trees. There were tapped 140 six-year old trees. They yielded 18½ grammes dry rubber per tree. Five-year old trees (200 were tapped) yielded 16½ grammes per tree, and four-year olds (of which 150 were tapped) yielded only 10½ grammes dry rubber per tree.

Comparative Tests.

Comparative tests were made with incisions on both sides of the tree, thus tapping practically the whole circumference of the trunk. But the extra yield, in the opinion of the lecturer, was relatively insignificant. It made no difference in the six-year old trees, and not much in the five and four-year old ones. Thus tests had been made in three different parts of Java at different heights above sea-level, with different soils, climates and rainfalls. The Solosebe ground had been well cultivated for a long time, but such was not the case at Uhlang and Besoeki. Some reports from Soember Telogo date back to 1880, 1882, 1885 and 1888. The oldest plantations at Kali-Mrawan date back fourteen years.

Taking the yield of the Solo trees at 193½ grammes, the Soember Telogo trees at 94 gram-

mes, and the Kali-Mrawan at 184½ grammes, we are still far off half a pound per tree, and it must be remembered that the yield begins to fail in the eighth year But even the yields named were not reached with repeated tapping. I only know one district in Java that favours the castilloa: it is in the Preanger, where the trees return 2 lb. of dry rubber each; but I am unable to say whether this refers to a limited or a large number of trees. It is always to be understood that the castilloa fumi yields more than the castilloa elastica.

I found castilloa yield 1½ lb. of dry rubber per tree in Ceylon—a 1 lb. yield being reckoned on for seven-year old trees. The question, therefore, arises, how is it that trees so generous in Ceylon are so niggardly in Java? I am at a loss for a reply. I hope for better results with the Hevea.—*Indian Trade Journal,* May 26.

"MANIHOT" RUBBERS ON THE NILGIRIS.

THE RUBBER FOR HIGH ELEVATIONS.

A planter, who signs himself "Hopeful," writes to us as follows from the Nilgiris:—

Sufficient time has now lapsed on the Nilgiris since planters started experimenting with the three new varieties of the *Manihot*, for at least one of these planters to state from actual experience, whether he thinks these rubbers will prove the salvation of the planter, who owns land at an elevation at which it is absolutely certain no rubbers such as Para, Castilloa, etc., will grow. At the start, no one could tell, not even the exporter of the seed from Bahia, the seller in Ceylon, or the purchasing planter, at what extreme height these *Manihots* would be a success. The general idea was that these varieties would grow at higher altitudes than the species above-mentioned, and consequently allow planters at these altitudes to participate in the great boom! It is only natural that planters whose land elevations prohibited rubber planting anxiously wanted a species that would really thrive in more temperate zones, and like the proverbial drowning man and the straw, when the *Manihot* arrived, with even the suspicion of a likelihood of its being grown profitably, at 5,000 ft. above sea level, there was a great rush to try it. As I will later on show, I do not think there is the slightest doubt that

THESE RUBBERS WILL DO, AND DO WELL, IN SHELTERED BLOCKS, AT EVEN 5,500 FT., ELEVATION.

Everything, however, must have its drawbacks or this disappointing old world would be too easy to live in, There certainly would be no booms of any kind. The great drawback, one which has well-nigh disgusted and compelled most experimenters to stop and abandon hope as to its being even moderately cultivated, is the utter impossibility of germinating even 5 per cent. of the seed! With the utmost care, *i.e.*, well-regulated heat, good drainage, the right amount of watering, etc., from 10,000 seed (90 per cent guaranteed sound) I have only managed to raise 250 plants, or 2½ per cent. The remaining ungerminated seed, if still carefully nursed, may distribute its germination over a twelve-month; but, at this rate, when would any appreciable area come into yielding? I think men at high elevations are far from wise to let this troublesome germination damp their ardour, or indeed make them "chuck it," as some seem inclined to do. Knowing that I have got hold of a good thing, I also know what my 2½ per cent of plants will yield in three years, in the way of cuttings; these are easy to strike, and

EACH THREE-YEAR-OLD TREE

(judging by the growth, which I shall presently describe, of one year old trees)

WILL AT LEAST YIELD 20 CUTTINGS,

at a modest estimate, so that every 250 plants a man owns at the present moment will, in three years, give him 5,000 cuttings and so on, *ad lib.* Thank Heaven with drawbacks there is the "law of compensation" also. As this is a subject which must interest a great number, I will now give the experiences up to date of another planter and myself, who were absolutely the first to try the *Dichotoma* and *Piauhyensis* on these hills at a high elevation. We started by purchasing a few *Dichotoma* plants from the Horticultural Gardens, Madras; this was during May-June, 1909. When planted on my friend's estate at an elevation of 5,400 ft., and on my estate at 5,750 ft., the average height of the plants was 1 ft. Today (exactly a year after) these trees average 6 ft., and some stand at 7 and 8 ft. All are branching beautifully, and what is most encouraging, many have a girth of 7 in. at the collar. These plants have

STOOD THE FIRST WINTER WELL,

frost lying in the valley not 500 yards away! I consider that my friend's elevation is the maximum height at which these rubbers will be quite satisfactory, as my *Dichotoma*, which is now 6ft., is not nearly as fine as his in girth measurement, in consequence of my 350ft. higher elevation. We have kept careful notes, and made searching enquiries from men who are growing these at elevations lower than 5,000ft. and from all the replies we have had and from what we have seen,

PERADENIYA IN CEYLON NOT EXCEPTED,

we have come to the conclusion that the *Dichotoma* will at anything below 5,000ft. grow spindly and tall, and from 5,000ft. up to 5,500ft. thick, robust and sturdy, provided always this variety is grown in well sheltered hollows. A Mysore planter was disgusted with the growth of his *Dichotoma* at 3,000ft. after seeing my friend's at 5,400 not only as regards girth, but also in height!—The above notes concern the

PLANTS BOUGHT AT THE HORTICULTURAL GARDENS, MADRAS.

Subsequently my friend got 2,000 seed from London, of which he raised 25 per cent plants. These he planted in the field six months later and all are now growing vigorously in a one-acre plot. This plot was visited by our Scientific Officer a few days ago and that gentleman, who has seen the growth of the *Dichotoma* in various localities and at various elevations, was astonished, as well as hugely delighted, at the growth and robustness of both *Dichotoma* and *Piauhyensis* on my friend's experimental acre. The rainfall, I might mention, is only 50 or 53 in yearly. It will yet pay those who think they have thrown away rupees on non-germinating seed, carefully to conserve all plants they have managed to raise, no matter how few; for in a short time they can multiply each plant many times over with cuttings.—*M. Mail,* June 1.

RUBBER PLANTING IN THE PHILIPPINES.

£300,000 BRITISH CAPITAL FOR DEVELOPMENT WORK.

2,500 ACRES TO BE PLANTED.

We are indebted, to an old Ceylon resident ,Mr T H Stephens, Dentist, Manila, brother o the well-known Dolosbage planters, for a copy of 'The Manila Times" (May 19th) containing the following article on rubber :—

Backed by nearly P3,000,000, (about £300,000) worth of capital to be used in development work in the Philippines, Captain A C Littler has returned to Manila after an extended trip through England and Scotland, where his missionary work for the islands brought out English and Scottish savings to be used in local industries. Captain Littler's first venture will be in the rich Cotobato valley of Mindanao, whither he will go next, to lay out the plantation of the

RIO GRANDE RUBBER ESTATES

Company, Limited. This concern will plant *2,500 acres of rubber.* Mr Frank Bost, a rubber expert, who has had experiencein Borneo, the Straits Settlements, and Central Africa, is now on his way here from England to take charge of the work. This company has a working capital of P400,000, most of it subscribed by Scottish capitalists. It was floated in Glasgow ; the stock was subscribed twice over. Difficulties encountered at the start in the floating of the company, were surmounted by the insurance of a prospectus containing an article on the rubber possibilities of Mindanao. published last year in the "Times." The company will devote itself entirely to proceeding the best grade of para rubber. Every possible care will be taken in the planting and cultivation of this product which, according to Captain Littler, can be grown better in Mindanao, than in any other part of the world. During the years of waiting for the rubber to reach maturity, the efforts of the company will be turned to the gathering of the wild rubber that is found in much profusion in many parts of the southern island. A special machine for the clearing and compression of this grade of rubber will be imported, and efforts will be made to pay the preliminary expenses of the plantation from the profits of this hitherto little exploited branch of the rubber business.

Speaking of his plans this morning, Captain Littler said : "If we can solve the labour problem, we will turn out a hard rubber that will be in every respect the equal of the hard para of the Malay Peninsula or the Amazon Valley. And we will be able to produce it cheaper than anywhere else in the world. "Our company has been organised on a cash box basis, we feel that our estimate of profits has been based upon a very fair consideration of the rubber market and its possibilities Many investors of Europe are becoming sceptical of putting their money in rubber development companies because of the alluring promises held out. But we have made no promises that we cannot fulfil. Rubber sells today at more than 11 shillings a pound. We can produce it at a large profit, selling it at slightly more than 3 shillings a pound. No rubber-producing country in the world can make a better claim. For our labour we expect to depend upon the Moro. With proper treatment, I am hopeful that the wild and semi-civilised man of Mindanao is capable of the labour necessary to the development of the island." Captain Littler spent yesterday in conference with the officials of the Bureau of Forestry preparing for his trip into the Moro country next week. The exact site of the land upon which the company will settle has not been decided, but it will be one of several sites in Mindanao. When the plantation of the syndicate has been put under development, Captain Littler will turn his attention to the lumber possibilities of Mindanao. He represents a syndicate that is ready to invest P2,000,000 in the development of the logging industry of the southern island.—*Manila Times*, May 19.

ARTIFICIAL RUBBER ONCE AGAIN.

We learn from London that Professor Harries, of Kiel, one of the leading authorities in Germany on rubber, claims to have discovered a valuable substitute for that commodity. The process is said to be based on the boiling together, under certain conditions, of isopren with acetic acid (*eisessig*). in a closed tube, the result being the creation of a grey composite, possessing all the properties of the purest rubber, and capable of being vulcanised in the same way as guttapercha. At present, this artificial rubber has only been produced in small quantities, but it is the Professor's opinion that when his method has been further developed it will permit the placing on the market of the article at one-third the cost of real rubber. The Professor's claim has attracted considerable attention, but is not believed. His article differs materially from numerous other proposed substitutes for rubber, which have failed when laboratory experiments succeeded, by attempts at commercial uses. Well-known scientists in Europe and America are devoting great attention to the subject, as the reward of a successful discovery would be enormous, exceeding, probably, that of the substitution of synthetic for natural indigo.

CEYLON CITRONELLA OIL.

COMPLAINTS AS TO QUALITY.

Messrs. Schimmel & Co., of Miltitz near Leipzig, London and New York, sent us by last mail their semi-annual report to the end of April, 1910. As usual, it contains interesting references to Ceylon essential oils. Ceylon cinnamon oil, we note, "has enjoyed a very active demand" and its manufacture in their works is steadily extending. In the year 1909 they distributed over 100,000 kilos of Ceylon cinnamon chips, while the sales exceeded in quantity those of the year 1908. The imports of cinnamon chips *via* Hamburg have again increased, being 2,941,578 lb. against 2,785,824 lb in 1908. Citronella oil is as usual exhaustively dealt with. The shipments of Ceylon citronella oil from Galle in the year 1909 reached the record, total-

ling not less than 1,512,084 lb., that is to say about 235,000 lb. more than in the previous year. The excess in shipments took place chiefly during the summer-months and had as a result that the prices receded to nearly 11d. per lb. We regret, however, to read that the supplies during the time under review occasionally left much to be desired in the matter of quality. This led to several claims in London, in the settlement of which Messrs. Schimmel & Co.'s opinion was invited. As a result of these claims the question of introducing a more stringent test to take the place of "Schimmel's Test," which, though it has proved its usefulness, no longer meets the present needs, has again become a matter of importance. How the test of citronella oil can be improved is discussed at some length, and Messrs Schimmel add that "The best plan of all would be if the Government of Ceylon were to superintend the citronella oil business on the spot as, according to statements made some time ago, appeared to be its intention. The oils ought to be tested by Government chemists and should only be allowed to be exported if they contained at least 60 per cent. totalgeraniol, and if in other respects also they conformed entirely to the tests prescribed. An official certificate to this effect should be given with each parcel of oil tested and the exportation of all oils *without exception* which failed to answer the test should be prohibited. We should regard it as a mistake if any relaxations were to be made, and oils of less than the standard quality were also to be admitted for exportation, as was the intention of the Ceylon Government in the year 1904. The rigorous enforcement of such a regulation would probably be attended by the best results, as it would mean a final removal of the evil and would once more turn the citronella oil trade into healthy channels." Some such proposal as referred to was, we believe, mooted in Ceylon at the end of 1904.

RICE INVESTIGATIONS IN HAWAII.

In a fertilizer experiment with rice it was found that 200 pounds per acre of a complete fertilizer gave practically as large yields of paddy as did greater quantities up to 800 pounds. Moreover, the results were approximately the same whether applied before the crop was planted, or when well advanced in growth. A number of cooperative fertilizer tests were made for the purpose of testing, on a commercial scale, the results already obtained on the trial grounds, and to bring greater profits, if possible from the rice industry. These experiments were entirely satisfactory, in so far as the results from the fertilizers were concerned, but were somewhat interfered with by the unusual insect troubles to which rice, was subjected during the past year. The variety of rice referred to in previous reports as No. 19, is now firmly established and has given excellent returns wherever it has been planted. Satisfactory progress is also being made with upland rice as a hay crop. —*Hawaii Agricultural Experiment Station Annual Report for 1909.*

SOUTH INDIAN PLANTERS AND THEIR SCIENTIFIC OFFICER.

From a lecture delivered by Mr R D Anstead, B.A., Planting Expert, at a Planters' Meeting held at Fairlawns, Yercaud, on April 28th, we quote a few paras :—

I am informed that

CEARA RUBBER

is showing every prospect of success in this district. I am very glad to hear it, and I am very much impressed with the possibilities of this Rubber from what I have seen of it in other districts. The climatic conditions which prevail on the Shevaroys should suit it very well. In a plantation of Ceara you will probably find a very great variability between the individual trees both in appearance and in yield of latex. While some trees give a good yield others hardly give any. Those of you who intend to extend your cultivation of Ceara should test your existing trees by experimental tapping, and when you find a really good one, break it up into cuttings and plant your new clearings with these. Those will give trees true to type, while seed will not come true owing to the natural cross-fertilisation which goes on between the bad and good trees. Ceara Rubber will respond to good land and good cultivation just as much as coffee or any other crop, and if it is to be grown seriously every attention should be paid to this. Suitable green dressings for Rubber will be found in the plants already mentioned and also in *Cassia hirsuta* and *Tephrosia tinctoria*, again both indigenous weeds.—*Planters' Chronicle*, May 14.

WORLD'S VANILLA CROPS.

Mr. Hermann Mayer Senior sends us these statistics of the 1909-10 vanilla-production :—

	Tons.
Seychelles	10
Bourbon	35
Mexican	70
Comores, Mayotte, &c. ...	40
Madagascar and Mossi-Bé ...	25
Mauritius	2
Ceylon, Java, Fiji, Zanzibar, &c.	10
Guadeloupe and Martinique...	15
Tahiti	180
Total ... (say about)	390

This quantity falls 110 tons short of the 1908-9 crop, and, as Tahiti shows an increase of 40 tons, the actual deficiency in the finer qualities totals 150 tons, or 40 per cent on the previous year's yield, which was of full average extent. Prices during the past twelve months have moved in accord with the statistical position, showing an improvement of 30 to 40 per cent for all varieties except Tahiti ; these have profited by the shortage of all other sorts and maintained their value, notwithstanding the larger returns. Only unimportant balances remain in the Colonies, and, as new crops are unlikely to be landed in quantity before November next, statistically the position appears exceptionally sound.—*Chemist and Druggist*, April 30.

"THE RUBBER TREE OF TONKIN AND NORTH ANNAM."

"BLEEKRODEA TONKINENSIS."

We have received a most interesting brochure written in French, by M. Ph. Eberhardt, Inspector of Agriculture in Indo-China, and M. Dubard. It is entitled "The Rubber Tree of Tonkin and North Annam, Bleekrodea Tonkinensis," and gives an account of this tree, which, it is stated, is indigeneous to the whole of north of Indo-China; that is to say, in a latitude in which Hevea cannot be developed. From the plantation point of view the tree presents the same advantages as Hevea, and the rubber is as easy to collect as that of the Ficus. It is excellent in quality, midway between Hevea and Ficus and nearer, perhaps, to Hevea to which it is very little inferior.

Attention was first seriously drawn to the tree in 1905, but it was not until two years later that M. Eberhardt and M. Dubard set out on an expedition to collect botanical samples, to tap some trees, and bring away some latex.

The result of their investigation is shown in an exhaustive botanical and scientific study of the plant in the brochure under review. Tapping was first done by natives, who accidentally discovered the value of the product, in a very haphazard way which, if it did not result in the death of the tree, caused it to undergo a long period of non-production. The natives, however, being lazy, gave it up after a time, as they did not find it worth their while. They made use of several methods of tapping.

In the first case they made, in the base of the trunk, about three feet from the ground, and on the large branches as many incisions as possible, by means of any cutting instrument, convinced that the more incisions they made, the more latex they would get. The quantity of rubber gathered in this way—instead of being more—is, on the contrary, less, for the normal flow of the liquid is no longer permitted, the circulation being interrupted; in addition, the latex gathered under these conditions contains a very large quantity of organic débris such as pieces of bark, lichens, and mosses.

Another way, one which is employed for the creepers, is to take off with a hatchet, or more often a simple knife, a large portion of bark.

In addition, by a third method, cruder even than the first two, more especially reserved for creepers, they divide the plants into parts and extract from each piece the latex which it contains, by warming one of the extremities over a slow fire. In this case, beside the latex, they gather at the same time the sap of the plant which oozes out of the piece just like a large amount of water.

In whatever way, however, he taps the tree, the native receives the latex in the little receptacles formed from an internode of bamboo, fluted at about two-thirds of its height in order to be able to apply this part of least thickness to the base of each wound. If he were content to gather his latex in this fashion, the bamboo would contain but a relatively small quantity of foreign matter; but that process would be too long, so he makes an odd twenty or so incisions with his knife in the same part of the trunk and, as he cannot place and hold there an equal number of bamboo tubes, he gathers with his finger the milk which flows from the wounds thus made and then wipes it on the edge of the bamboo tube. One can thus see how much foreign matter he is forced to introduce into it at the same time, scraping in some degree the whole surface of the bark which he naturally does not take the trouble to wipe or wash beforehand. The gathering having terminated, the bamboos are transported either to the village or to a neighbouring stream of water; there they are put into a pot full of water which without any care, is boiled. Drawn from the bamboo tube, the product obtained by coagulation is in the form of a "black pudding." This nearly always contains a certain quantity of organic matter generally found in the centre. The presence of this organic matter has been characterised as a fraud, but it is not really —for what follows is what actually happens:

The latex of the Bleekrodea coagulates very quickly; a part even coagulates of itself in the receptacle in which it is carried. This coagulation is still further facilitated by the movement which the latex is submitted in transport and which acts as a sort of churning, releasing sufficient heat to separate a certain number of globules of the serum and hasten their adhesion. In this first coagulation, however, all foreign organic matters are imprisoned; when, shortly afterwards, all is subjected to heat, all the globules not separated during the voyage stick to the core formed by the first coagulation, the "black pudding" lengthens at the two ends and imprisons in its midst the impure mass. Sometimes, before putting the latex in boiling water, the natives draw out the first ball formed, which explains the presence in the market of unformed balls, generally very much reduced, and of an inferior quality.

There is no doubt, however, that the Bleekrodea Tonkinensis will become one of the great economic products of the colony. We give the following translation to show its commercial value:—

"The commercial value of Bleekrodea rubber has been determined by Messrs Hecht Brothers from two samples which were sent them by Mr. E Perrot, the learned professor of the School of Pharmacy, to whom we had sent them, at his request, to obtain an estimate. One was a sample which had been treated with ether, deprived of foreign matter; it was priced at from 8 francs to 8·50 francs a kilo (2·2 lb.) The other was a crude sample carelessly gathered by natives and containing many impurities. It had naturally coagulated without the help of any acid and was valued, despite its impurities, at 5·50 francs a kilo. It should be added that this estimate was made when Para was valued at 9·50 francs. Bleekrodea rubber is, therefore, a rubber of a very fair quality."

Ceylon Agricultural Society.

ANNUAL GENERAL MEETING.

REFERENCE TO HIS LATE MAJESTY KING EDWARD VII.

The annual general meeting of the Ceylon Agricultural Society was held at noon on June 8th at the Council Chamber. H. E. Sir Henry McCallum presided, and the others present were :—The Hon. Mr. H. L. Crawford, C.M.G., the Hon. Mr. W. H. Jackson, the Hon. Mr. C. T. D. Vigors, the Hon. Mr. P. Arunachalam, the Hon. Mr. S. C. Obeyesekere, Captain E. M. Slaughter, Extra A. D. C., Messrs. P. D. Warren, R. B. Strickland, W. D. Gibbon, G. W. Sturgess, E. E. Green, E. Cowan, A. Harbord, Dr. J. C. Willis, Dr. H. M. Fernando, Messrs. Jas. Peiris, F. L. Daniel, Alex. Bruce, A. E. Rajapakse, A. P. Goonatilleke, Tudor Rajapakse, W. A. de Silva, C. Drieberg (Secretary), and a few visitors.

A VOTE OF CONDOLENCE.

Before the business on the agenda was taken up, HIS EXCELLENCY—all the members standing—said :—Gentlemen, since we last met a terrible calamity has befallen the nation. Suddenly, without warning, the Angel of Death swept down, and has taken unto himself our most beloved Sovereign, King Edward VII. It is a blow not only to us personally and collectively in Ceylon, but a tremendous one to the whole nation; and in sustaining this blow, I am sure I am voicing the feelings of this Society when I say that our deepest sympathy goes forth to those who were near and dear to him, and whom he has left behind him. I think, therefore, before we proceed with the ordinary business of the day, that we should at once, at this our first meeting since his demise, in a brief resolution, put on record our feelings concerning the calamity I have referred to and our sympathy with the Royal Family. I, therefore, will ask you in solemn silence to assent to the following resolution which I have prepared for your acceptance:—

"That it is with feelings of the deepest sorrow that this Society has heard of the sudden demise of their well-beloved Sovereign King Edward VII. Whilst bowing to the inscrutable decree of Divine Providence, the Society submissively desires to record its keen sense of the terrible loss which the nation has sustained by the early passing away of its sagacious, powerful and far-seeing monarch, the protector and lover of his people. With fervent loyalty the Society humbly begs that an expression of the profound sympathy which it feels in their deep affliction may be conveyed to Their Majesties the King and Queen, to the Queen-Mother and the members of the Royal Family."

H. E.'S TRIBUTE TO CEYLON'S LOYAL SYMPATHY.

After a moment's silence, His Excellency continued :—Gentlemen, you have accepted the resolution. I may say that I feel glad of this first public opportunity I have had to say how deeply impressed I have been with the sincere sorrow and fervent loyalty which have been manifested throughout the length and breadth of Ceylon in connection with the death of our late Sovereign. From high and low, rich and poor, from village, hamlet and Societies—practically from everybody—the Governor has received most eloquent testimony of the intense feeling which this sad event has brought about. These expressions of regret and loyalty are being collected in a volume and will be forwarded in due course, together with memorials of all sorts and descriptions, to be laid before Their Majesties, as soon as all the resolutions, such as the one you have just passed, have been handed in.

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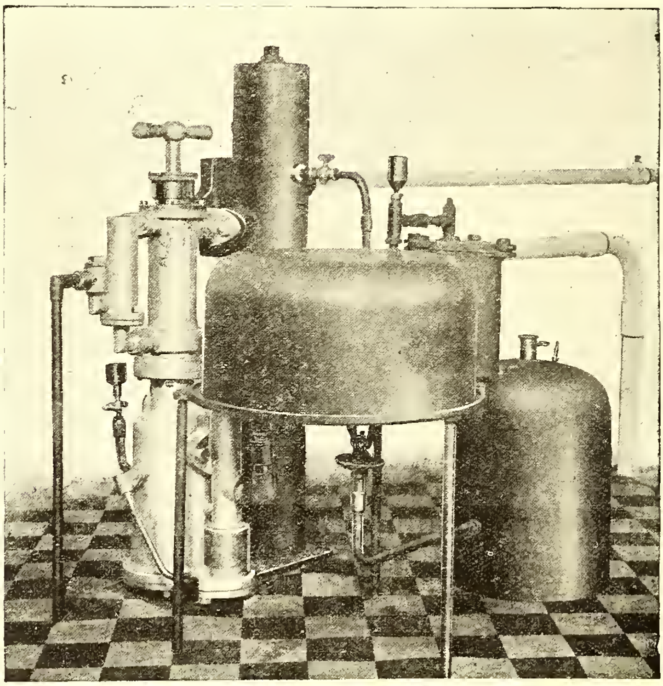

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